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ABSTRACT

This resource guide provides information about the range of activities that can be implemented to maintain and improve the condition of research collections to ensure that they remain usable as long as possible. After an introduction that describes the major activities and a review of an investigation process that gives an overview of good practice, the following articles are presented: (1) "Handling Books in General Collections" (Library of Congress); (2) "Care and Handling of Library Materials" (John DePew); (3) "Preservation Guidelines for Processing Staff" (University of Texas at Austin); (4) "Preservation Guidelines for Circulation and Stack Maintenance Personnel" (University of Texas at Austin); (5) "General Preservation: What an Institution Can Do To Survey Its Own Preservation Needs" (Karen Motylewski); (6) "Storage and Handling: Choosing Archival-Quality Enclosures for Books and Paper" (Karen Motylewski); (7) "Storage and Handling: Cleaning Books and Shelves" (Northeast Document Conservation Center); (8) "Preservation" (Ann Swartzell); (9) "Guidelines for Using Vacuum Cleaners" (National Archives and Records Administration); (10) "Collection Management" (American Library Association); (11) "Reformatting: Microfilm and Microfiche" (Northeast Document Conservation Center); (12) "Archives and Manuscripts: Conservation" (Mary L. Rizenthaler); (13) "Basic Conservation of Archival Materials: A Guide" (Canadian Council of Archives); (14) "Care, Handling, and Storage of Photographs" (International Federation of Library Associations and Institutions); (15) "Storage and Handling: Storage Enclosures for Photographic Materials" (Northeast Document Conservation Center); and (16) "The Care and Handling of Recorded Sound Materials" (Giles St-Laurent). A bibliography lists 19 selected readings for further study. (SLD)

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Preservation Planning Program

Collection Maintenance and Improvement

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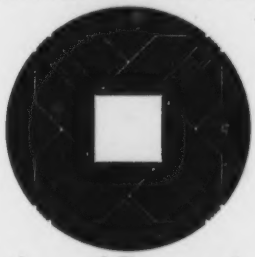

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Preface

This is one of seven in a series of Preservation Planning Program (PPP) resource guides. Support for their preparation was provided by a grant from the National Endowment for the Humanities. The resource guides offer libraries comprehensive, easy-to-use information relating to the major components of a preservation program. The goal is each case is to construct a conceptual framework to facilitate preservation decisionmaking as it relates to a specific program area. ARL was fortunate to be able to draw on the extensive experience of a diverse group of preservation administrators to prepare these resources. Guides cover the following topics:

- Options for Replacing and Reformatting Deteriorated Materials
- Collections Conservation
- Commercial Library Binding
- Collections Maintenance and Improvement Program
- Disaster Preparedness
- Staff Training and User Awareness in Preservation Management
- Organizing Preservation Activities

Taken together, the guides serve as points of departure for a library's assessment of current practices. From the rich and diverse preservation literature, materials have been selected that relate principles or standardized procedures and approaches. The intent is to provide normative information against which a library can measure its preservation efforts and enhance existing preservation activities or develop new ones. The resource guides build on the body of preservation literature that has been published over the last decade. Every effort has been made to reflect the state of knowledge as of mid-1992.

The resource guides were prepared primarily for use with the *Preservation Planning Program Manual* developed and tested by the Association of Research Libraries, with support from the National Endowment for the Humanities. However, they prove useful to all those involved in preservation work in academic and research libraries. The guides may be used individually or as a set.

Each resource guide is divided into four sections. The first presents an overview and defines the specific preservation program component. The second section guides the review of current practice, explores the developmental phases that can be expected as a preservation program component develops, and lists specific functions and activities. The third part brings together key articles, guidelines, standards, and excerpts from the published and unpublished sources. The last section contains a selected bibliography of additional readings and audiovisual materials that provide additional information on a specialized aspect of each topic.

As libraries continue efforts to plan and implement comprehensive preservation programs, it is hoped that the resource guides will help to identify means of development and change and contribute to institutional efforts to meet the preservation challenge.

Jutta Reed-Scott
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INTRODUCTION AND PROGRAM DESCRIPTION

Collection Maintenance and Improvement

This resource guide provides information about the full range of activities that can be implemented to maintain and improve the condition of research collections to ensure they will remain available for use as long as possible. The physical conditions that comprise the micro-environment, such as storage systems, housekeeping, and handling factors are the concerns of this guide. This resource guide does not address the macro-environmental factors in library buildings such as temperature, humidity, light, and air quality.

The guide is divided into four sections. Section 1 is an introduction that defines the topic and describes the major activities. Section 2 steps through an investigation process that assists library staff in reviewing current practice and the state of activities. Section 3 contains articles, manuals, and other resources that provide an overview and information on standardized procedures and guidelines of good practice to help identify areas for improvement and change. Section 4 contains a selected bibliography of additional materials that provide greater detailed information on specialized aspects of the topic.

This resource guide focuses primarily on the needs of books and serials in circulating collections. This group usually makes up the largest portion of the library collection for which we have responsibility. Some consideration will also be given to archives, microforms, and photographic materials. The bibliography provides additional readings and citations to guide the review of collection maintenance programs for other media. The information that is presented in this resource guide can be modified and adapted to suit the specific needs and situation of each institution.

Definition of Collection Maintenance and Improvement

"Collection maintenance and improvement" is the phrase used to describe the range of basic preservation activities performed to extend the useful life of library materials. Proper shelving, housekeeping routines, and good care and handling practices are the kinds of activities that protect library materials and help prevent physical and chemical deterioration.

A conscious inclusion of preservation concerns in collection maintenance includes traditional stack maintenance activities and processing routines redefined to focus attention and incorporate practices that contribute to the improvement of collections. Proper shelving with volumes well supported by bookends, shifting to ease overcrowding, vacuuming of volumes, and cleaning of microform readers are a few examples of routine maintenance activities. Improvements in collections can be accomplished through such activities as spine-down shelving rather than fore-edge shelving and early identification of damaged materials at points in the processing stream. A comprehensive maintenance and improvement program should address all types of materials and every format under the institution's care.

A well-planned and implemented collection maintenance and improvement program will ensure that stacks, reading rooms, and areas for nonbook media are neat and clean, that materials are properly protected, and that materials are handled with care. This not only minimizes unnecessary damage and physical stress, but encourages the proper use of research collections by patrons and staff, sending the message that library materials deserve respect and care. Improved collection maintenance and well-established care and handling guidelines can often trigger changes and improvements in other library routines, procedures, and policies. The long-term benefit is increased longevity and maintenance of collections in usable condition.

The primary responsibility for implementing collection maintenance and improvement activities rests with circulation staff and with public service staff charged with providing service for special units and media facilities. Responsibility also resides with a wide range of technical processing and other staff that handle materials during acquisition, cataloging, shelf preparation, and binding. Cleaning or building maintenance staff may also have an important role to play where housekeeping is concerned. The role of library administration is to ensure that clear, firm policies are in place and that priorities for collection maintenance and improvement are established and supported.

Elements of a Collection Maintenance and Improvement Program

The basic elements of a collection maintenance and improvement program can be divided into five categories: storage and shelving systems; housekeeping routines; general care and handling practices; care and handling routines in processing; and collection improvement activities.

Shelving and Storage Systems. The basic elements of a good shelving and storage system protect materials and minimize damage. Proper shelving should be made of heavy-duty steel with a smooth, epoxy finish or a baked-enamel finish that has been cured. Improperly cured baked enamel can release gases that may be harmful to materials. Wooden shelving is the least desirable because of lignin and other acidic products that can leach out and damage materials. If wooden shelves must be used, a minimum requirement is that they be properly sealed, or lined with polyester film or an acid-free paper to provide a protective barrier. Sturdy metal bookends that support volumes upright, a sufficient amount of shelving to prevent overcrowding, and adequate air space surrounding book shelves for ventilation are other basic elements. Sound storage systems also extend to the use of flat shelving for folios, adequate space for removing and reshelving oversize volumes, steel cabinets with a baked-enamel finish, and drawers with dust covers to protect maps and flat items from slipping or being caught and damaged.

Housekeeping. A regular program of cleaning library stacks and vacuuming books can minimize the damage that occurs when dust and dirt accumulations absorb moisture that accelerate deterioration. Cleaning books will extend their useful life. The frequency of cleaning should be determined by how rapidly dust and dirt accumulates in areas where books are stored. Some institutions have established a 1- to 2-year cleaning schedule, while others recommend a cycle that takes up to 8 years to complete. A basic maintenance program for book stacks should aim for a maximum 5-year cycle to clean all collections. Judgement should be exercised to modify the schedule with varying conditions. For example, book storage areas located in large cities, industrial areas, or in buildings with minimal air filtration should be cleaned more frequently, while storage in areas with good air filtration and low pollution require cleaning less often. The cleaning schedule should ensure that there are no heavy accumulations of dust or dirt.

Cleaning projects and activities that accompany a shift are further opportunities for keeping stacks neat and clean. A project approach can also be used to address specific collections or areas in greatest need. Policies that eliminate food and drink in the library or restrict food to specific areas assist in the effort to keep materials clean and help minimize the problems of damage to collections by insects and rodents. Policies that eliminate smoking in the library help to control damage from polluting chemicals and gases in the air.

General Care and Handling. Well-established care and handling practices focus on the broadest group of activities that protect materials as they are handled and used by both patrons and staff. Methods of removing volumes that protect the top of the spine, using bookends to close up space and provide vertical support when volumes are removed or returned to the shelves, and proper procedures for removing and reshelving oversize volumes and flat items are the essential practices that promote longevity. The use of book trucks to carry volumes, the correct loading of trucks, and encouraging careful and gentle handling of items when they are photocopied are additional daily activities that can minimize unnecessary damage as materials are used.

Care and Handling in Processing. The need for preservation-conscious care and handling practices extends to the tasks and activities that are carried out daily by staff. Circulation and reserve functions, acquisitions and cataloging activities, shelf-processing, and binding routines each have shelving and storage, housekeeping, and handling responsibilities that contribute to the maintenance of collections. Circulation staff will usually have primary responsibility for reshelving and other stack maintenance activities. In addition, performing charge and discharge tasks, monitoring and emptying book drops, and removing bookmarks, paper clips, or other items before volumes are shelved are all tasks with implications for preservation. Cataloging and acquisitions staff must be concerned with proper storage and shelving while materials await processing, non-damaging methods to open books and hold them open for processing, and the potential damage that can be caused by paper clips, tape, rubber bands, and thick packets of information that are inserted into volumes. Maintenance-related shelf-processing activities are concerned with the care and neatness with which activities are performed and also with the quality of supplies used for marking and labeling. Many pressure-sensitive spine label protectors, date due slips, barcodes, bookplates, and book pockets are acidic and chemically unstable with the potential to contribute unnecessary damage to many materials in the longterm.

Collection Improvement. Several points in circulation and in the processing stream are ideal places to screen and identify damaged and problematic materials. The identification of damaged materials for preservation attention is the most important collection improvement component in a maintenance program. Approaches to identification can be retrospective, prospective, or a combination. Worn, damaged, and embrittled materials can be identified for review after they return from circulation or are removed from reserve; brittle, unbound, or inadequately protected volumes can be spotted and rerouted to receive preservation treatment before they are processed or shelved for the first time. Additional improvement tasks can be taken on by staff, particularly in units responsible for circulation. These include relatively basic procedures of protection and stabilization, such as tying a volume with detached covers or placing a damaged or fragile item in some type of protective container. These tasks require little training and are generally quick and easy to perform since this work is done when items are reshelved. Any tasks needing more time or training should be sent to a repair or conservation unit where work is performed by trained staff in an equipped treatment facility.

The Library Investigation. An investigation of the Library's collection maintenance and improvement efforts will involve three phases.

Phase I

Phase I begins with a data-gathering effort that aims to inventory and describe preservation activities. The inventory involves the identification of places where materials are stored and used and a description of physical conditions and housekeeping routines. It also identifies locations and processing units where care, handling, and improvement activities are performed, supplemented by a description of tasks indicating to what degree preservation-conscious practices exist. The final effort in the inventory phase is to gather any existing policies, practices, procedures, or training materials that have been developed for or relate to collection maintenance and improvement activities. These can exist as written documentation or be gleaned from interviews and discussions with supervisors and staff.

The following are checklists that can assist in identifying the areas, locations, units, and activities for consideration in the investigation.

Checklist for Identifying Storage Areas

- ☐ **All Library Buildings** (where materials are stored and used. Include separate floors and spaces where materials and conditions may vary)
- ☐ **Storage Facilities** (on- or off-site)
- ☐ **Book Stacks** (open or closed)
- ☐ **Reading Rooms**
- ☐ **Backlog Storage** (for processing, gifts, review, etc.)
- ☐ **Microform Reading Rooms**
- ☐ **Media Facilities**
- ☐ **Photocopy Areas**
- ☐ **Book Drop Locations** (places with external or internal book drops)

Checklist for Identifying Processing Units

- ☐ **Circulation Desk**
- ☐ **Reshelving Areas**
- ☐ **Acquisitions Processing**
- ☐ **Cataloging Units**
- ☐ **Shipping Room**
- ☐ **Shelf Preparation**
- ☐ **Commercial Binding**
- ☐ **Review Areas** (for selectors)

The following checklists will assist in the process of examining and evaluating conditions in the book stacks and in the book drop areas. Additional checklists, such as lists for microform reading rooms and for various media, have been produced by others and are reproduced in this resource guide. More information can be found in the bibliography section of this guide.

Book Stacks Checklist

1. **Shelves:**
   - ☐ Are shelves and cabinets steel with a baked-enamel finish?
   - ☐ Are wooden shelves and storage furniture properly sealed or lined to provide a barrier?
   - ☐ Is there enough shelving?
   - ☐ Is there good air circulation?
2. **Shelving:**
   - ☐ Are shelves neat and orderly?
   - ☐ Are books packed firmly but not too tightly to prevent damage when they are removed from the shelf?
   - ☐ Are books off the floor, on shelves at least 4" above the floor?
3. **Bookends:**
   - ☐ Are volumes supported upright, not leaning, with the appropriate size bookend?
4. **Folios:**
   - ☐ Are oversize volumes stored flat?

- ☐ Are there no more than 3-4 books stacked on a shelf?

- ☐ Are shelves large enough to support items?

- ☐ Are there open shelves or tables to help with removing and reshelving volumes?

5. **Dust/Dirt:**
   - ☐ Are the shelves, books, and stack areas clean, uncluttered, and dust-free?

   - ☐ Are housekeeping routines adequate to keep stack areas clean?

6. **Food:**
   - ☐ Is food, drink, and smoking prohibited from the building and collection areas or restricted to specified areas?

   - ☐ Are garbage cans provided and emptied daily?

7. **Infestation:**
   - ☐ Is there evidence of insect or rodent damage (e.g. droppings, mottled spines, stains, shredded paper?

   - ☐ Is there routine extermination?

See also Northeast Document Conservation Center. What An Institution Can Do to Survey Its Own Preservation Needs. p.8, IID. Pests; p.10, IV.B. Pollution; p.11, IV.D. Insects, rodents, mold; p.11-12, IV.H. Furniture, and Mary Lynn Ritzenthaler. Archives and Manuscripts Conservation. SAA Basic Manual Series, p. 66-67.

Book Drop Area Checklist

Policy:

☐ Are book drops closed when the building is open?

Equipment:

☐ Is the chute the shortest distance and at a gentle slope?

☐ Is the bin spring-loaded and cushioned?

Unloading:

☐ Are book drops unloaded with a frequency that prevents volumes from piling up or overstuffing and jamming the bin?

Phase II

The second phase of the investigation should look at the administrative, organizational, staffing, and training issues related to collection maintenance and improvement activities. The goals and policies of the library's collection maintenance and improvement program should be established by the person with primary preservation responsibility. It is the role of the library administration to affirm these goals and policies and to ensure that institutional support is clearly articulated. Implementation and maintenance of an effective program will inevitably mean changes in library routines; it is essential, therefore, that impetus and support come from senior management.

One model for implementing such a program would be to institute an active "preservation" training program for shelvers and other staff performing related tasks and to establish a formal advisory role for the person with primary preservation responsibility regarding collection maintenance and improvement policies and procedures.

A second model would shift responsibility for traditional maintenance activities to the organizational unit with primary preservation responsibility. With clear lines of authority, it may be easier, for example, to encourage staff whose mission is "preservation" rather than "reshelving" to incorporate and accomplish both tasks as well as to establish new tasks such as vacuuming books and shelves. There may also be more flexibility in making use of staff time during periods when workloads vary. The goal of either model is to ensure that those who handle large quantities of materials also contribute to their preservation. Individual institutions should adapt a model or make modifications that are appropriate for the situation.

In both cases, an active and ongoing staff training component is essential to educate staff and to ensure activities are carried out in accordance with established guidelines. All staff will benefit from gaining an understanding of how maintenance procedures enhance the overall preservation effort as well as from training focused on how specific tasks should be performed.

Phase III

The readings in this resource guide provide a thorough discussion of the storage conditions, housekeeping routines, and care and handling practices that are employed to accomplish the maximum protection for library collections. It is a combination of published books and articles, institutional training manuals, and audiovisual materials. These can be used initially as a way to identify and define the types of conditions and activities to look for in the inventory. Throughout the investigation, they will further serve as guidelines to measure and assess the level of activity and effectiveness of what is currently in place, determine what is lacking, and point to what further changes and new directions are needed.

Conclusion This resource guide provides information about the full range of activities that can be implemented to maintain and improve the condition of research collections to ensure they will remain available for use as long as possible. The size and scope of a program will vary to meet the needs of each institution and the availability of staff and resources will influence implementation. Regardless of these factors, a minimum program must have at least the following basic components:

1) Proper shelving, cabinets, and book ends that provide nondamaging storage for materials

2) A regular housekeeping program or project-based cleaning efforts that focus on areas most in need
3) Policies that keep food, drink, and smoke away from collections
4) A staff training program for shelvers and other processing staff that handle materials
5) A mechanism to identify items for preservation

Collection Maintenance and Improvement for Microforms

Microforms of all types—microfilm and microfiche, and silver halide, diazo, or vesicular microforms—are making up an increasing portion of library collections. This section addresses the concerns of the microforms housed in the "service" collections that are available for use. They may also be referred to as "work" copies. Archival storage for preservation masters will not be included here, but additional information on this topic can be found in the bibliography.

A collection maintenance and improvement program for microforms has several of the components in common with books and serials. Basic elements include: good storage conditions that include proper shelving or cabinets and nondamaging enclosures that protect microforms; a regular housekeeping program to minimize dust and dirt; policies that keep food, drink, and smoking away from collections; and care and handling practices that protect materials in use.

Beyond these basics, there are components that should be emphasized and others that are unique to microforms and other non-book media. These include the use of proper storage enclosures, equipment maintenance, and collection improvement activities.

Storage Enclosures. Although the concern is with storage of "use" collections, it is important to remember that microforms have some special needs and they can be susceptible to damage. Even when possible, it is unlikely that a library will be able to replace or repurchase large portions of the collection if it is damaged. Therefore, it is in the institution's best interest to protect their collection by using as many kinds of enclosures or containers as possible that follow established standards for long-term preservation storage. The choice of storage materials will be a compromise between degree of protection required, cost, and practical considerations of access.

The American National Standards Institute (ANSI IT9.2 - 1991) specifies that enclosure materials meet four criteria: 1) that materials be free of acids and peroxides that cause degradation; 2) that the enclosure itself be chemically stable; 3) that the physical surface of the enclosure not be too smooth to cause sticking or too rough to result in abrasion; and 4) that all enclosures meet the requirements of the photographic activity test.

The Standard recommends that paper used for storage of black and white photographic materials have a pH between 7.2 and 9.5 with an alkaline reserve of at least 2 percent. Paper should have an alpha cellulose content of 87 percent and contain no lignin, groundwood, or alum-rosin sizing. Paper ties that hold microfilm secured on reels, microfiche envelopes, microfilm boxes, storage cases or boxes for film stored on open shelves, and microfiche dividers that prevent curling are examples of acceptable enclosures. The adhesives on fiche envelopes and other enclosures can also cause damage. Therefore, envelopes should be chosen without adhesive or with a seam running along the side rather than down the center. Fiche should be inserted with the emulsion side away from the adhesive or seam. If choices must be made, the most stringent criteria should be followed for storage materials that are in direct contact with photographic materials and provide the first layer of protection.

Paper that is in direct contact with diazo or color photographic materials should have the same composition as above except that the pH should be between 7.0 and 7.5 and the paper should not be buffered with an alkaline reserve.

Storage boxes and enclosures can also be made of "safe" or "preservation-grade" plastics which are inert, unplasticized, uncoated, and have good chemical stability. One example is the microfilm reel. For other elements of the storage system, paper tends to be preferred in the library environment. (For additional information on photographic materials, see the enclosed resources and citations listed in the bibliography.)

Equipment Maintenance. A major difference between microforms and books is the dependence on equipment to use the information in this format. Frequent inspection and maintenance will reveal the condition of equipment and prolong its life. Well-maintained equipment in good running order is an essential element to ensure that materials are protected in use.

A daily maintenance program should be in place to clean viewing screens, glass flats, mirrors, and carriers. Dust and dirt can obscure the image but it can also scratch and abrade the microform surface. Daily inspection will also identify minor problems that can be corrected immediately. Weekly inspections should be conducted to detect unreported problems, make routine repairs, and identify more major maintenance problems for service technicians.

Improvement Activities. Two key points of activity are ideal for inspecting microforms and for making decisions that contribute to long-term improvement of the collection--at the point of acquisition and at the time of circulation. First, as a preventive measure, all incoming microforms should be inspected. This is the opportunity to spot problems with quality or errors that can be corrected by the vendor, to remove packaging that may be damaging (e.g., rubber bands), and to rehouse items in proper storage enclosures. Second, a spot inspection at the time of circulation or use provides another occasion to identify such problems as dirt, scratching, tears, or evidence of fungus or other blemishes and to upgrade storage materials.

Conclusion. The minimum components of a basic program for collection maintenance and improvement for microforms include:

1) Use of proper storage enclosures that come in direct contact with microforms and form the first layer of protection
2) A regular equipment maintenance program that includes daily cleaning and weekly inspections
3) Good housekeeping routines to remove dust and dirt
4) A training program for staff that handle microforms
5) Policies that keep food, drink, and smoking away from collections
6) An inspection program for incoming materials

Collection Maintenance and Improvement for Archives

The scale and variety represented by archival records dictate a maintenance and improvement program designed to meet the needs of diverse and disparate materials. The size of archival collections, the uniqueness of many materials, and the relationship of individual parts to the whole are factors that must be taken into consideration. A central focus of the archivist's

preservation activities are actions taken to retard or prevent deterioration or damage to materials—effective housekeeping, the provision of a stable physical environment, and care routines. A primary responsibility of the archivist is to plan storage and care for a wide range of record materials.

A collection maintenance and improvement program for archival records consists of the same basic elements common to all library materials. Added to this are the responsibilities of planning storage and care for a wide range of nonbook formats. Three important areas that deserve emphasis are the quality of storage materials, care in processing, and routines that contribute to collection improvement.

Storage Materials. As archival collections are processed and integrated into existing collections, old acidic containers and filing materials should be replaced. All boxes, file folders, envelopes, or mats used in conjunction with archival materials should be made according to ANSI specifications which recommend that paper have an alpha cellulose content of 87 percent and contain no lignin, ground wood, or alum-rosin sizing. The paper or board should be buffered to a pH of 7.2 to 9.5. Storage materials that meet these specifications are available from reliable "preservation" suppliers in a wide variety of standard sizes and formats to meet most collection needs. A variety of plastic materials can also be used for storage. These must be inert, chemically stable, and contain no plasticizers, filters, coatings, or UV absorbers. The most common preservation-grade plastic found in libraries and archives is polyester (e.g., Mylar D or Melinex 516). (See the bibliography for sources on the care and storage of nonbook formats.)

Processing Routines and Collection Improvement. While a collection is being organized, destructive fasteners such as paper clips, staples, or rubber bands and other foreign objects such as ribbons, locks of hair, or pressed flowers should be removed. As these materials age and deteriorate, they can tear and stain paper and cause other kinds of damage to archival records in storage and in use. The process of arrangement and description can also offer an opportunity to enhance and improve the condition of collections. As accessioning activities are carried out, a checklist can be created that will highlight specific problems and areas for preservation attention.

Collection Maintenance and Improvement for Photographic Materials

Photographic materials (such as prints, film base and glass plate negatives, slides) should be housed to prevent chemical deterioration and physical damage. Proper shelving, cabinets, and storage enclosures can stabilize fragile materials and provide basic care. A collection maintenance and improvement program for photographic materials consists of the same basic elements common to all library materials: good storage conditions that include proper shelving, cabinets, and non-damaging enclosures; regular housekeeping routines; and care and handling practices that protect materials in use.

An area that should be emphasized is proper storage enclosures. When planning storage systems, one must take into consideration how materials may be used, their condition, and the distinction between items for long-term preservation and those intended as working copies. Familiarity with the many photographic processes is also important for selecting appropriate storage enclosures for photographs. A basic principle for storage is that each photographic medium should be housed separately, whenever possible.

Storage Enclosures Photographic materials should be stored in either paper or plastic enclosures or sleeves. ANSI standard (IT9.2) recommends that paper enclosures have an alpha cellulose content of at least 87 percent and contain no lignin, alum-rosin sizing, or groundwood. Paper should have a pH of 7.2 to 9.5 with a 2 percent alkaline buffer and must meet the requirements of the Photographic Activity Test. Unbuffered paper with a pH between 7 and 7.5 that contains no alkaline buffer is recommended for the storage of diazo and color.

As a general rule, buffered enclosures are recommended for the storage of most photographic materials. Enclosures made from buffered material will last longer than unbuffered. In practice, both buffered and unbuffered papers have been used. Research in this area has lead some to prefer the use of unbuffered papers under certain conditions. (See additional sources in the bibliography for examples and conditions where one may be preferred over the other.)

Plastic enclosures should be made from an inert plastic such as polyester, polyethylene, or polypropylene. Plastics that have fillers, coatings, UV absorbers, or plasticizers should be avoided.

Plastic vs. Paper. Paper enclosures are usually chosen for materials that do not receive heavy use. While paper enclosures generally cost less and provide a convenient surface for marking, items that receive frequent use can be more easily scratched and abraded. Plastic enclosures, on the other hand, are preferred for frequently used items. They protect items from fingerprints, provide physical support, and provide clear viewing without having to remove the item. When using plastic, special consideration should be given to the level of humidity. If it is high, the photographic emulsion of a negative or print can soften and stick to the surface causing ferrotyping (the appearance of shiny spots on the emulsion).

For a more detailed discussion and information on care and storage of photographic materials, see the additional sources listed in the bibliography.

Collection Maintenance and Improvement for Magnetic and Other Media

Magnetic recording technologies are becoming a growing component in library and archive collections. The most common magnetic media encountered serve three areas: data storage, audio recordings, and video recording. Examples include floppy disks or diskettes, computer tapes, cartridges, audio and video cassettes, and open-reel magnetic tapes.

Magnetic media, the recording material, the base material, and the binder can undergo physical and chemical changes that can alter quality, cause distortion, or render information irretrievable. Tapes and diskettes are vulnerable to damage from inherent media instabilities as well as from external conditions. Wear caused by improper winding and rewinding, malfunctioning or improperly adjusted recording and playback equipment, and damage from dust and other contaminants are some of the most common threats to information recorded on magnetic media. As with many types of media, important considerations to maintaining the stability of magnetic media include proper storage conditions, handling practices, and equipment maintenance.

Storage. Magnetic tapes and diskettes should be shelved upright in a vertical position to prevent warping and away from damaging heat sources and sunlight. Containers, protective envelopes, and wrap-arounds for reels should be used to minimize the accumulation of dust. Protective

housing should be constructed of stable plastic, noncorrosive metal, or alkaline-buffered paper. Very small dust particles can make portions of magnetic media unreadable; a clean, dust-free environment and regular cleaning and housekeeping routines are essential. Eating, drinking, and smoking should be eliminated from areas where magnetic media is stored and used. Tape should be stored in the "tails out" position. For long-term storage, a program of rewinding is recommended.

Handling. Magnetic media should be handled gently and contact limited to the protective housing. Reels of tape should be carried by their hubs and diskettes by their edges to prevent damage from skin oils and fingerprints. Paper clips, rubber bands, or fasteners should not be attached to diskettes. Adhesive labels can be used on containers or protective envelopes. Graphite pencils and erasers that generate debris should be avoided. Whenever possible, magnetic media should be inspected after use to identify such problems as scratches, tape rubbing against a flange, or damage to protective housing.

Equipment Maintenance. It is important to maintain recording and playback equipment in proper operating condition. Because dust and other contaminants can cause damage, those machine components that come into contact with magnetic media, read/write heads, rollers, and guides should be cleaned frequently. A regular program is needed to provide preventive maintenance, to correct minor problems, and to identify problems for repair.

Other Media

Libraries and archives are responsible for the protection and care of all types of media in their collection. Each type of media has a set of characteristics, needs, and requirements that must be taken into consideration when planning a maintenance program that insures the greatest longevity. The list of citations in this resource packet is a place to begin to identify the nature and the requirements of these complex media. Many publications include extensive bibliographies for more indepth information. The field is rapidly changing, and new information is constantly being published, thereby making it increasingly important to keep informed about new developments.

SELECTED DOCUMENTS

Selected Documents

Books and Serials - General Sources

DePew, John. "Care and Handling of Library Materials." In *A Library, Media, and Archival Preservation Handbook*. Santa Barbara, CA: ABC-CLIO, 1991. 89-97.

This article includes information on the care and handling of books, including shelving, removing and replacing books, opening new books, uncut volumes, and the hazards of inserts, paperclips and rubberbands. It also provides information on all aspects of the preservation of print and nonprint materials.

Library of Congress, Preservation Office. *Handling Books in General Collections*. Washington, DC: Library of Congress Preservation Office, 1984.

This ten-minute video with printed script describes the proper handling and storage of library collections. It includes information about shelving, removal, replacement and transportation of books, general handling, and photocopying.

Motylewski, Karen. *General Preservation: What an Institution Can Do to Survey its Own Preservation Needs*. Technical Leaflet. Andover, MD: Northeast Document Conservation Center, 1991. Reprinted with permission from the Northeast Document Conservation Center.

This document includes a full survey and check list for environment, storage, and shelving; and a good summary of storage and handling practices. It also covers nonbook materials.

Motylewski, Karen. *Storage and Handling: Choosing Archival-Quality Enclosures for Books and Paper*. Technical Leaflet. Andover, MD: Northeast Document Conservation Center, 1992. Reprinted with permission from the Northeast Document Conservation Center.

The General Libraries, The University of Texas at Austin. "Preservation Guidelines for Processing Staff" and "Preservation Guidelines for Circulation and Stack Maintenance Personnel." In *Preservation of Library Materials: A Manual for Staff*. Austin, TX: The General Libraries, The University of Texas at Austin, 1986.

These articles contain good general guidelines focusing on the orientation and training of staff.

Books and Serials - Housekeeping

National Archives and Records Administration Preservation Department. *Guidelines for Using Vacuum Cleaners*. Washington, DC: National Archives and Records Administration Preservation Department, 1990.

Storage and Handling: Cleaning Books and Shelves. Technical Leaflet. Andover, MD: Northeast Document Conservation Center, 1992. Reprinted with permission from the Northeast Document Conservation Center.

Swartzell, Ann. "Preservation." *RTSD Newsletter* 7 (1985). Chicago, IL: American Library Association. (First published in *The New York State Library*.)

Microforms

"Collection Management." In *Microforms in Libraries: A Manual for Evaluation and Management*. Chicago, IL: American Library Association Reproduction of Library Materials Section, 1985. 27-36.

This article includes instructions for storage, processing, marking and labeling, collection maintenance and repair, maintenance of reading and printing equipment and cleaning instructions.

Reformatting: Microfilm and Microfiche. Technical Leaflet. Andover, MD: Northeast Document Conservation Center, 1991. Reprinted with permission from the Northeast Document Conservation Center.

This document contains brief general guidelines on storage environments and enclosures, care and handling, and selection and maintenance of equipment.

Archives

Canadian Council of Archives. *Basic Conservation of Archival Materials: A Guide*. Ottawa, Canada: Canadian Council of Archives, 1990. Available from the Canadian Council of Archives at $10.00 per copy (taxes and Shipping Fees included.)

This guide contains a good basic chapter on care that includes guidelines on handling of materials in storage and in use. See pp. 25-39 for rules for users, housekeeping, and storage systems. It also provides general information for all formats.

Ritzenthaler, Mary Lynn. *Archives and Manuscripts: Conservation*. SAA Basic Manual Series. Chicago, IL: Society of American Archivists, 1983. copyright 1983. Reprinted with permission from the Society of American Archivists.

This document contains some excellent detailed sections on storage equipment and materials, and also provides general information on storage. For all formats, see pp. 38-47; housekeeping, pp. 35-36; processing practices and collection improvement routines, pp. 53-55; and a conservation self-study questionnaire with several questions to help examine and gather data on maintenance issues, pp. 66-67.

Photographic Materials

International Federation of Library Associations and Institutions. *Care, Handling, and Storage of Photographs*. IFLA Core Programme Preservation and Conservation Preservation Packet. Washington, DC: Library of Congress, 1992. This work was made possible by the International Federation of Library Associations and Institutions (IFLA) and by the Council of Library Resources under the auspices of the Robert Vosper IFLA Fellows Programme.

This packet contains very current information, including a good section on suggested storage methods for many types of photographic materials. It also includes a list of standards, supplies, and a bibliography.

Storage and Handling: Storage Enclosures for Photographic Materials. Technical Leaflet. Andover, MD: Northeast Document Conservation Center, 1989. Reprinted with permission from the Northeast Document Conservation Center.

This document contains basic information on the storage of photographic materials. There is a difference of opinion regarding the use of buffered versus unbuffered paper for the storage of materials.

Magnetic and Other Media

St-Laurent, Giles. *The Care and Handling of Recorded Sound Materials.* Ottawa, Canada: National Library of Canada, Music Division, 1991. Distributed by the Commission on Preservation and Access, Washington, DC.

This document contains basic guidelines for the care and handling of discs, tapes, and compact discs organized by three principles: minimizing foreign matter deposits, minimizing deformations, and the proper storage environment.

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AUDIOVISUAL INSTRUCTION MATERIAL

The National Preservation Program Office of the Library of Congress has prepared a slide show and six videotape programs on library preservation practices and techniques. The slide show presents a general overview of the subject, while the videotapes are intended for use as supplemental training aids by qualified instructors teaching basic conservation procedures for general collections. The following is a list of titles available and prices.

Slide Show

The slide show is accompanied by an audio cassette narration (with inaudible pulse) and printed script for advancing the slides manually if automatic playback is not used.

1. "Handling Books in General Collections"
An overview of proper and safe storage and handling of books by library and staff. Intended primarily for staff and users. *79 slides, 10 minutes*

Price	Quantity	$ Total
$60.00		

Videotapes

A six-part series on "Library Preservation: Fundamental Techniques" is offered in ½" VHS format. The series was recorded at Stanford University at a conference designed to reach library staff at all levels involved in the development of institutional preservation programs. Simple conservation and repair procedures for library materials are illustrated. A written instruction booklet accompanies each tape. The tapes may be purchased singly or as a complete set.

	Price	Quantity	$ Total
1. "Surface Cleaning, Encapsulation, and Jacket-making" *60 minutes, ½" VHS*	$30		
2. "Books in General Collections: Paper Repair and Pockets" *81 minutes, ½" VHS*	$30		
3. "Pamphlet Binding" *60 minutes, ½" VHS*	$30		
4. "Books in General Collections: Recasing" *70 minutes, ½" VHS*	$30		
5. "Protective Enclosure: Simple Wrappers" *52 minutes, ½" VHS*	$30		
6. "Protective Enclosure: Portfolios and Boxes" *114 minutes, ½" VHS*	$40		
7. Special: All 6 parts of "Library Preservation: Fundamental Techniques" *½" VHS*	$150		

VIDEOTAPES OF GENERAL INTEREST

1. "A Tour of the Library of Congress"
An excellent introduction to the Library's vast collections and services. Explore the treasures of the world's largest library, which include the Gutenberg Bible, the Stradivarius violins in concert, rare photographs, maps and movies. The Library's preservation program, history of the collections and user access to the collections are also covered in this video presentation. *(20 minutes, ½" VHS)*

Price	Quantity	$ Total
$25.00		

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2. **"Legacy of Law"**
An award winning video summary of the Law Library within the Library of Congress. This department houses the world's most comprehensive collection of foreign, international and comparative legal sources. A useful introduction for legal organizations, libraries and law schools. *(12 minutes, ½" VHS)*

Price	Quantity	$ Total
$25.00		

3. **"A Conversation With Gwendolyn Brooks"**
A video portrait of this Pulitzer Prize winning Consultant in Poetry to the Library of Congress for 1985-1986. Miss Brooks is best known for literary works which portray scenes of city life. She shares her thoughts that "humor, wit, mischief and love are all part of black life" *(30 minutes, ½" VHS)*

Price	Quantity	$ Total
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4. **"A Conversation With Richard Wilbur"**
The nation's second Poet Laureate reminisces about his life and work with interviewer Grace Cavalieri. A winner of both the Pulitzer and National Book Awards for Poetry, Mr. Wilbur is also well known as a critic and translator. *(30 minutes, ½" VHS)*

Price	Quantity	$ Total
$25.00		

5. **"Hymn of the Nations"**
Arturo Toscanini conducting Giuseppe Verdi's *Hymn of the Nations* with the Westminster Choir and the NBC Symphony Orchestra. New introduction by Burgess Meredith, 1988. *(30 minutes available in Beta, VHS, or 8 mm format—please specify choice)*

Price	Quantity	$ Total
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"Handling Books in General Collections"
(Summary of Points Raised)

The care with which a book is handled by readers and library staff members directly affects its longevity; proper handling and storage can prolong the life of a library's collection.

I. Appropriate shelving for books of ordinary size

1. Smooth, solid shelves; no jagged edges or protruding screws
2. All books upright, resting on their base
3. Bookends for shelves that are not full
4. Full shelves that are not too loosely or too tightly packed
5. All books on shelves that are a minimum of 4" above the floor

II. Appropriate shelving for oversize books

1. Broad, fixed shelves; roller shelves
2. All books flat, if possible, with not more than three or four volumes on top of each other
3. No protrusion of books into aisles

III. Appropriate removal of ordinary-size books from shelves

1. Ease books on either side of the desired volume further back on the shelf
2. Grasp exposed book by the sides with the whole hand
3. Readjust the bookend

IV. Appropriate replacement of ordinary-size books on shelves

1. Loosen bookend
2. Move books on shelf to create a space
3. Reinsert book in the space
4. Readjust the bookend

V. Appropriate removal of oversize books from shelves

1. If stored flat, transfer upper volumes to a free shelf or adjacent book truck
2. Remove desired volume with <u>both</u> hands
3. Transfer upper volumes back onto shelf

VI. Appropriate replacement of oversize books on shelves

1. If stored flat, transfer upper volumes to a free shelf or adjacent book truck
2. Replace volume on the shelf with <u>both</u> hands
3. Transfer upper volumes back onto shelf

VII. Transport of books

Use a book truck that is

1. Easily maneuverable
2. Has wide shelves or protective rails to secure the items in transit
3. Has bumpers on corners to minimize damage from inadvertent collisions

Load the book truck so

1. Books are upright, as they are on the shelf in the stacks
2. Books are not protruding beyond the edges of the truck
3. The center of gravity on the loaded truck is low

VIII. General handling of books

1. Keep hands clean
2. Avoid food, drink, or smoking materials in close proximity to books
3. Support covers when book is open
4. Avoid forcing books to open further than they open easily
5. Avoid excessive use of enclosures; avoid placing any enclosure in the joint just under the cover
6. Avoid the use of paper clips in the text

IX. Photocopying

1. Support covers and pages of book while in the process of photocopying
2. Avoid forcing volume flat on copy machine
3. Learn to recognize and do not attempt to copy books whose size or structure prevent them from copying easily or well
4. Microfilm materials that are too brittle to photocopy safely, and offer patrons print-outs, or copies of the film itself

Damage to books is cumulative. Repeated poor handling can quickly transform a new book into a worn book, and a worn book into an unusable book that requires costly repair or replacement. Proper use of books by each individual prolongs the life of a library's entire collection.

Library of Congress
National Preservation Program Office
Washington, D.C. 20540
July 1984

HANDLING BOOKS IN GENERAL COLLECTIONS:
GUIDELINES FOR READERS AND LIBRARY STAFF MEMBERS

	Narrative	Slide Description
1.		1. Title slide
2.	Books form such an integral part of our daily lives that, until they fall apart in our hands, we rarely think of them as perishable commodities.	2. Woman studying book in reading room.
3.	Yet libraries spend thousands of dollars each year in the repair, rebinding, and replacement of damaged volumes in their general collections.	3. Damaged books.
4.	The care with which a book is handled by readers and library staff members directly affects its longevity; proper handling and storage can prolong the life of a library's collection.	4. Shelf of books in good condition.
5.	The following information suggests appropriate handling and shelving practices for ordinary books in general collections.	5. Two women studying a book and searching for a book, respectively.
6.	It describes the correct methods for taking books off shelves and putting them back safely;	6. Woman preparing to remove a book from a shelf.
7.	how to open and use them without damage; and how best to photocopy them.	7. Woman photocopying a book.
8.	Books are constructed from organic materials that vary in chemical and physical stability.	8. Materials used to construct a book.
9.	They resist physical wear and tear to different degrees.	9. Cloth bindings—in varying conditions.

Narrative	Slide Description
10. Pages and bindings are easily damaged if handled roughly.	10. Split image: unsupported open book (l) and torn page (r).
11. The majority of bindings are most vulnerable at the joint, where the cover is hinged to the text.	11. Book tearing at the joint
12. Additionally, many modern papers are chemically unstable and become brittle in a relatively short time. Extreme care must be exercised in handling brittle paper.	12. Book with broken, brittle paper.
13. Proper shelving and storage are important factors in extending the life of all books.	13. Many shelves of books.
14. The safest storage for them is on smooth, solid, shelves.	14. Close-up of a smooth, solid shelf.
15. Avoid shelves that are runged.	15. Close-up of runged shelf.
16. Also avoid shelving that has protruding screws or jagged edges.	16. Close-up of jagged edge on old upright.
17. Since they spend so much time on the shelves, good posture for books promotes physical well being.	17. Two shelves of books in a carpeted library.
18. Ordinary sized volumes should be stored upright on shelves, resting on their base. Avoid stacking them on top of each other or on top of upright volumes.	18. Correct and incorrect shelving.
19. Books placed on their fore edges or spines, or allowed to lean,	19. Book shelved on its fore edge, and book leaning on shelf

Narrative	Slide Description
will gradually be pulled out of shape by the effects of gravity.	20. Split image: Detail of book shelved on its fore edge, and book leaning on shelf.
Always use bookends on shelves that are not full. They keep the books from falling over, and support the outside board on the end volume.	21. Row of books supported by bookend.
It is important that the bookend be large enough and strong enough to fulfill both of these functions successfully.	22. Book leaning because bookend is too small.
Some metal bookends are very narrow, and care must be taken to avoid pushing the text over a thin bookend when a volume is reshelved.	23. Detail of book pages bent by bookend.
On full shelves, a happy medium must be struck between loose and tight packing of the volumes. Loose packing is inefficient and encourages the books to lean. Tight packing leads to damage resulting from the force that must be exerted in order to remove or replace books.	24. Books shelved too loose, too tight, and correctly.
Friction and stress created by forcing this book in and out of a shelf space that was too narrow for it broke the book cloth along the joint.	25. Book with spine cloth broken along one joint.
Once this happens, the book has lost a portion of its protective covering. Other sorts of breakdown may then occur,	26. Detail of book with spine cloth broken along one joint.
such as loosening of the cover from the text or the total detachment of cover boards.	27. Book with cover detached.

Narrative	Slide Description
28. It is never good practice to stand or pile books on the floor. Unexpected water leaks, routine janitorial maintenance, book trucks,	28. Books on the floor in the stack area.
29. and feet will damage them needlessly.	29. Foot kicking books on the floor in the stack area.
30. A good rule of thumb to follow is that all library materials should be shelved a minimum of four inches above the floor.	30. Row of books shelved four inches above the floor.
31. Careless handling in the process of circulation is a major cause of of physical breakdown in books. A particularly vulnerable time for most books is when they are being removed from and replaced on the shelf.	31. Man removing book from shelf by its end cap.
32. The easiest, but most damaging, way to remove a book from its shelf is to hook the index finger over the end cap and pull.	32. Detail of finger hooked over end cap.
33. End caps are not a strong feature in most bindings. Repeated use of the end cap as a handle leads to a torn or broken spine piece.	33. Books with damaged end caps and spines.
34. A better technique is to ease the books back on either side of the desired volume,	34. Woman pushing adjacent volumes further onto shelf in preparation for removal of desired volum
35. then grasp the exposed book by the sides with the whole hand,	35. Woman removing desired binding from the shelf.
36. and readjust the shelf space.	36. Readjusting the bookend after desired volume is removed.

Narrative	Slide Description
37. Oversize books—inordinately tall, wide, or thick—frequently have bindings that are weak in proportion to their size and weight. They cannot be stored safely on ordinary vertical shelving.	37. Books of various sizes.
38. Oversize books should be stored flat on broad, fixed shelves or roller shelves, with not more than three or four volumes resting on top of each other.	38. Removing an oversize book from roller shelves.
39. A common hazard in oversize shelving is that volumes may protrude into the aisles because the shelves are too shallow.	39. Book truck moving long aisle into which books are protruding.
40. This situation makes them vulnerable to damage from passing individuals and book trucks.	40. Item on book truck hitting a volume that protrudes into aisle.
41. It can be alleviated somewhat by using double-width shelves.	41. Books on a double-width shelf.
42. In reshelving, move the book end to loosen the whole row of books on the shelf so that ample space at the appropriate position can be created	42. Woman loosening bookend in preparation for reshelving.
43. in which to insert the book.	43. Replacing a volume on the shelf.
44. Once it is in place, readjust the row and reset the bookend.	44. Tightening bookend after a volume has been reshelved.
45. The temptation with horizontally shelved oversize volumes is to lift the stack with one hand and slide the desired volume out with the other. As a result, the book can be dropped easily.	45. Woman pulling oversize item out from under two other volumes.

Narrative		Slide Description	
45.	A safer method is to have intermittent free shelves in the stacks so that upper volumes can be transferred to one of them.	46.	Woman placing oversize volumes on unoccupied shelf
47.	Both hands are free to grasp and support the volume firmly as it is removed. If shelf space is limited, a nearby table or book truck would suffice.	47.	Woman using both hands to lift oversize volume fro the shelf.
48.	If oversize books are stored vertically, move adjacent volumes completely away on one side so that—again—both hands can be used to handle the volume.	48.	Oversize volumes, vertically shelved.
49.	Dropping a book even a short distance can cause severe damage.	49.	Woman dropping a book.
50.	Do not carry more than you can handle.	50.	Damage to a dropped book.
51.	When in doubt, use a book truck. Choose a truck that is easily maneuverable, has wide shelves or protective rails to secure the items in transit, and has rubber bumpers on all four corners to minimize damage from inadvertent collisions.	51.	Book truck.
52.	Place the books on the truck as they would be shelved in the stacks. Don't pile them on top of each other, and take care that they don't hang over the edges.	52.	Properly loading a book truck.
53.	Load the truck so the books won't jostle off the shelves in transit. For maximum stability keep the center of gravity low.	53.	An improperly loaded book truck.

Narrative		Slide Description	
54.	Books are too often treated casually and handled incorrectly or inappropriately in the course of daily use.	54.	Coffee cup sitting on book.
55.	Clean hands, and the avoidance of food, drink, or smoking materials in close proximity to books are minimal requirements for proper handling.	55.	Repair manual on engine.
56.	The binding structure of a book will survive longer if the boards are always supported when the book is open.	56.	Woman properly supporting the spine and boards of an open book.
57.	Many volumes do not open easily and refuse to rest open to a given page.	57.	Tight binding that won't remain open on table.
58.	Forcing these books to open further; and exerting strong pressure on them so they will remain open, puts great stress on both spine and joints.	58.	Bending a book backward to keep the pages open.
59.	Excessive use of enclosures in books can distort and eventually break the binding because their presence strains the structure. This is particularly true if the book is used like a filing cabinet or	59.	Books filled with inserts.
60.	if a thick wad of materials is inserted in one place.	60.	Single book with wad of inserts under front cover.
61.	When the temporary insertion of enclosures in a book cannot be avoided, minimize strain on the binding by	61.	Inserting catalog cards and reserve slip in the center of a book.
62.	placing them in the middle of the volume, rather than in the joint just under the cover. Remove them as soon as possible.	62.	Book with inserts placed in the center of the text

Narrative	Slide Description
63. If an enclosure must remain in the volume for an extended period, make sure it is made of an acid-free, non-damaging material.	63. Acid-free inserts.
64. Acidic enclosures pose a chemical threat to the paper because certain materials in them may migrate into adjacent leaves, causing them to deteriorate and discolor.	64. Pages of book stained by contact with insert made of low-quality paper.
65. Avoid paper clips. If they are left in the text, they crimp the pages and may eventually damage them with rust.	65. Damage from a paper clip.
66. Photocopying machines are standard equipment in most libraries. Unfortunately, none of the wide variety of machines available is designed to insure photocopying of books without damage.	66. Photocopy machine.
67. The very act of forcing a tightly bound book flat on the surface of a copying machine	67. Woman forcing a book flat on a copy machine.
68. subjects the spine and sewing to more stress than they are designed to withstand.	68. Pages detached during photocopying.
69. Also, as open books are flipped over for copying pages, all portions of the binding come under great strain.	69. Book being flipped over for positioning on successi photocopy machine.
70. Weak, brittle paper may be bent or broken. Several options are available for minimizing these hazards.	70. Brittle book damaged in photocopying.
71. The most practical is to support the covers and pages of a book in the process of photocopying, and to avoid forcing the volume flat on the machine.	71. Supporting book covers and text block while the volume is on the photocopy machine.

	Narrative	Slide Description
72.	Learn to recognize, and do not attempt to copy, books whose size or structure prevent them from copying easily or well.	72. Trying to put an atlas on a copy machine.
73.	This would include volumes with tight bindings and narrow gutter margins.	73. Book with a narrow gutter margin.
74.	Materials that are too brittle to photocopy should be microfilmed. Patrons requesting copies can either be offered print-outs or copies of the film itself.	74. Microfilm and microfilm print-out.
75.	These storage and handling practices may not seem significant when considered in connection with one use cycle of one book. But damage to books is cumulative.	75. Woman checking out books to patrons.
76.	Repeated poor handling can quickly transform a new book	76. New, undamaged book.
77.	into a worn book, and a worn book	77. Same book, showing wear and tear.
78.	into an unusable book that requires costly repair or replacement.	78. Book with binding broken and leaves detached.
79.	Proper use of books by each individual prolongs the life of a library's entire collection.	79. Man studying in reading room.

Narrative	Slide Description
80. Please—do your part!	80. Many people studying in reading room.
81.	81. Credits.
82.	82. National Preservation Program Office Publication

Library of Congress
National Preservation Program Office
Washington, D.C. 20540
July 1984

32

A LIBRARY, MEDIA, AND ARCHIVAL PRESERVATION HANDBOOK

John N. DePew

Santa Barbara, California
Denver, Colorado
Oxford, England

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3.
CARE AND HANDLING OF LIBRARY MATERIALS

3.A. Introduction

This chapter covers the storage, care, handling, exhibit, and security of books. Similar information for audio-visual materials, i.e., audio and video disks, film, magnetic tape, and photographs is discussed in Chapter 6.

3.B. Care and Handling of Books

The procedures discussed in this section will be of no value if the staff and public are not made aware of the necessity of handling books and other library materials with care. Education of the staff and patrons in preservation will help prolong the life of collections. This can be accomplished "by including preservation information in staff orientation programs, by mounting exhibitions about preservation or conservation, by including articles on preservation in staff and student newspapers [and by inviting reporters from city newspapers to do stories on preservation], or by preparing" [20:45] audio-visual programs, book bags, bookmarks, demonstrations, handouts, manuals, posters, and signs.

Preservation of books in general collections begins by selecting and using proper shelving and bookends, then learning how to remove, store, and replace books on shelves; how to use book trucks properly; how to handle books in ways that will prolong their lives; and how to utilize good circulation and photocopying techniques.

3.B.1. SHELVING

Library bookcases should be constructed of steel with a baked enamel finish. Wooden shelves should never be used in an archive or

library because of the possibility of the wood outgassing harmful compounds [see section 2.E.2]. The shelves should be smooth and solid, without rungs or slots, and free of jagged edges and protruding screws. The bottom shelf should be no less than four inches above the floor in order to avoid problems from rising water and splashes from cleaning. Shelves and their bracing should be checked annually for looseness. If the shelf is braced by diagonal guy wires, the wires can be tightened to correct looseness or sag. [See section 8.C.1 for a discussion of bracing shelves against earthquakes.]

Bookends should also be made of steel, with a baked enamel finish. They should be free of sharp edges and rust, and high enough to support over half the height of the book. A properly designed bookend should be thick enough to be easily seen on the shelf and constructed so it won't "knife" a book when it is pushed onto it. Wire bookends that hang from the shelf above should be avoided, because books tend to slip under them and slide into a leaning position. Bookends that are too short and/or made of thin metal can be economically modified by gluing cardboard to the upright part of the bookend and covering the cardboard and the metal with buckram. [2]

Similarly, map, blueprint, or poster cases should be constructed of steel with a baked enamel finish. Drawers should not be more than two inches high and should be fitted with hoods or dust covers to protect the contents from slipping or being caught up under the drawer above. Drawers more than two inches high can hold too many items, causing overloading problems such as bunching, tearing, or wrapping during removal and replacement.

3.B.1.a. Shelving, removal, and replacement of normal-sized books

Books should be shelved upright, resting square on their bases. They should not be placed on their fore edges, allowed to lean, or packed too tightly or too loosely. Most bindings are weakest at the joint or hinge area. When a book is shelved fore edge down, gravity will eventually and inevitably pull the text block from the case at the hinge. Bookends should always be used for shelves that are not full. Do not stack volumes on top of each other or on top of other upright volumes.

When removing a book from the shelf, gently push the books on either side of it farther back on the shelf. If this is not possible, place an index finger firmly on the top edge of the book (not on the headcap) and tilt the book out of the shelf. With the whole hand, grasp the desired volume by the sides at midspine and remove it. Then readjust the bookend, if necessary, and straighten the shelf. Removing books in this manner will save fragile headcaps from becoming frayed and breaking. Use a step stool to reach high shelves.

Before reshelving, dust books to remove damaging dirt and set aside volumes needing repair. Securely fasten all portfolios and boxes

protecting fragile materials. To replace a book on the shelf, loosen the bookend and move the books on the shelf to create a space for the volume. Reinsert the book into the space and readjust the bookend. As noted above, do not shelve the book fore edge down. If the book is too high for the shelf, it can be shelved spine down, and an acid-free slip with the call number can be placed in the center of the text block. This approach, however, can cause problems of its own, such as the slip being lost and the book jutting out into the aisle. A better solution is to adjust the shelf height or provide special shelving for oversized and folio volumes. [2]

3.B.1.b. Shelving, removal, and replacement of oversized books

"Oversized books . . . frequently have bindings that are weak in proportion to their size and weight [and] . . . cannot be stored safely on ordinary vertical shelving." [10] Broad, fixed shelves or roller shelves should be provided for oversized volumes. Sometimes double-width shelves can be used for this purpose. Ideally, folios should be stored flat, one to a shelf. If this is not possible, they should be stored flat with no more than three or four volumes on top of each other. There should be no protrusion of books into the aisle. Empty shelves should be interspersed throughout the stack area so volumes that are being removed to get access to another book can be transferred to them. If space does not permit the use of empty shelves, a table should be provided nearby upon which to place the volumes. Another possible solution for shelving oversized books is to designate special stack areas for vertical shelving where they can be shelved together. Volumes of like size can provide better support for each other, but over time, gravity will pull them away from their spines.

Use *both* hands when removing an oversized volume from a shelf. If it is not the top volume on the shelf, and the books are stored flat, transfer the upper volumes to a free shelf or a nearby table or book truck. Do not pile them on top of each other. Do *not* pull the book out from between other volumes, because the chances of damage and falling are great. If the transferred books are being placed on a book truck, make sure they are neatly stacked, do not hang over the edges, and are low enough on the truck to maintain its stability. After the desired book has been removed, transfer the upper volumes back to the shelf.

Unbound materials, such as maps and broadsides, are often oversized and stored in piles. The procedures described above should be used to remove a desired item from the stack. Do not drag the wanted material out of the pile, as such handling increases the possibility of tearing. [2]

To return an oversized book to a shelf, repeat the procedure above. If the volumes are stored flat and stacked on top of each other, move the volumes with *both* hands to a free shelf, book truck, or table. Replace the volume on the shelf with *both* hands and transfer the upper volumes back onto the shelf. [2]

University of Texas at Austin

1. PRESERVATION GUIDELINES FOR PROCESSING STAFF

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PRESERVATION GUIDELINES FOR PROCESSING STAFF

The success of library preservation programs at The University of Texas at Austin depends upon the cooperative efforts of the entire staff, including everyone who processes library materials. This manual is intended to provide staff in the Bibliographic Control Division and other processing areas with a heightened awareness of library preservation needs and correct methods of handling the material they process and transport so that all unnecessary damage can be avoided.

A. OPENING MATERIALS

It is essential that care be taken in opening packages, cartons, or materials tied together for transport, whether they come from outside the university (from jobbers or publishers) or are sent from within the university.

1. Use of tools

If an X-acto knife, scissors or other sharp utensil is used to open a sealed package, use it carefully to avoid gouging the materials inside.

2. Handling and inspection

Handle materials carefully while removing them from the package, examining them for damage or defects which may require returning a book and requesting replacement, or sending the book to Book Repair. Some categories of damaged books are easily identified. Books with loose **hinges** where the **text block** sags, with severe water damage, with damaged or loose **spines** or **covers**, and with loose pages are some of these obvious categories. An example of a defective book is one which has been bound upside down.

damaged books

Do not attempt the repair of a book unless you have been trained by the Book Repair Unit staff in making repairs. Otherwise refer damaged volumes to Book Repair.

B. TRANSPORTING MATERIALS AMONG THE PROCESSING AREAS

Handle and transport books carefully. Improper loading and removal of books from book trucks is one of the most frequent causes of damage to library materials and potentially the most preventable if all personnel learn proper handling and transportation techniques.

Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

1. Hand carrying

When hand carrying books, carry moderate armloads.

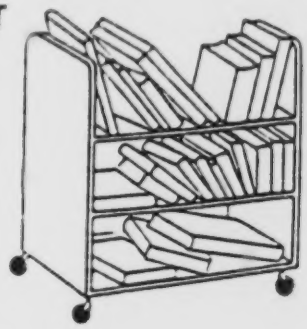
hand carrying

2. Book trucks

Place books on trucks in an upright position with no other materials stacked on top of them. If a shelf of a truck is only partially full, keep books vertical with a book end or with a group of books laid flat to support the others. Do not place them on their **fore edges** even for a short period of time - as for example when arranging them in call number order - since this can cause the body of a book to come loose from its **covers**.

Large **folio** volumes should be placed flat on a shelf.

NOT



Transporting unbound materials on book trucks requires special consideration. Unbound materials with some rigidity can receive proper support through use of **Princeton-files** or book ends. Unbound materials with little rigidity would easily fall over or down even if conveyed in such files or with book ends; they should be placed flat in small neatly stacked piles in order to prevent them from easily slipping off the truck.

unbound materials

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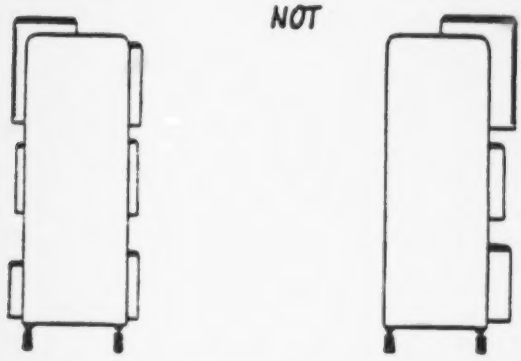
balancing weight on trucks

Two other important points to remember when loading a truck are not to overload it and to evenly distribute the weight. Do not jam books too tightly on the shelf. Even, balanced distribution and normal-sized loads make the truck easier to manage and prevent it from tipping over.



maneuvering trucks

Move book trucks carefully on and off elevators, around corners, and in narrow passages, paying special attention to any material which may be protruding. Let your supervisor know if an elevator is not stopping evenly or if a truck seems wobbly or unstable.

Refer also to section C., SHELVING

3. Unloading book trucks

Many of the above instructions should also be followed when unloading. Refer also to the next section on shelving.

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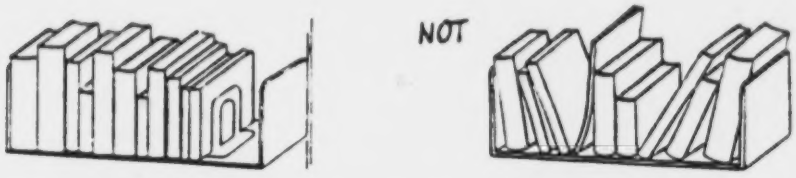
C. SHELVING AND STORAGE OF MATERIAL

As materials move through the processing units, they remain in a variety of shelving/storage environments, sometimes on a long-term basis. In order to avoid damage to the materials, it is essential that some basic storage techniques be adhered to. The same principles should be applied whether materials are stored on an individual shelf beside the cataloger's desk or are shelved in Twelve-Month Hold in Automated Cataloging on a long-term basis.

1. Position and placement of books

Place a book on the shelf so that it stands vertically and upright and is gently supported by the books on either side, additional support being supplied by book ends. Books should not be shelved too loosely. They can be permanently bent or splayed if this is done.

proper position of books

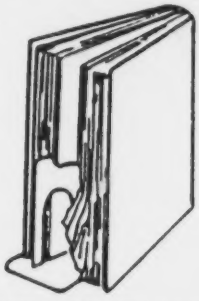


Jamming books too tightly on the shelf should be avoided. Overcrowding can create problems in the easy removal of books from the shelf. Binding damage can also result.

overcrowding

Library book ends should be free of sharp or rusty edges. When possible, they should support over half of the height of the book and should have a wide profile. When shelving near a book end be careful not to accidently "knife" the pages of the book with the edge of the book end. Report the need for more book ends or other book end problems to your supervisor.

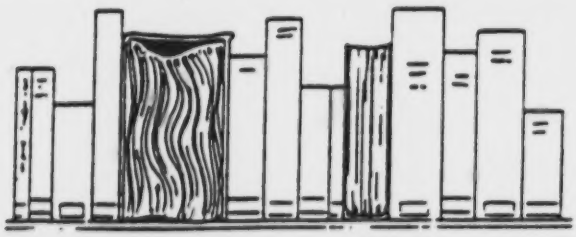
book ends



Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

Fore edge shelving is unacceptable since it can cause the **book block** to loosen from its **case** . If a volume is too tall to shelve vertically, it is preferable to shelve it on its **spine** rather than on its **fore edge**.

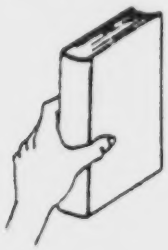
fore edge shelving is wrong

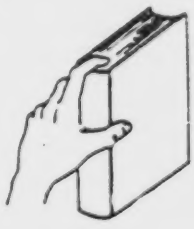


When removing a book from the shelf never pull it by the top of the **spine**, since this might cause **headcap** damage. Rather the two adjacent volumes should be pushed back slightly in order to grasp the book firmly for removal.

removing a book

NOT





2. Oversized volumes

It may not be possible to stand oversized volumes upright or to provide separate oversized shelving areas in all processing areas. If this is the case, oversized volumes should lie flat, no more than three deep on the shelf, on shelves deep enough to support them, or they should be shelved on their spines. Very large tomes, such as those found in art studies, should always be shelved flat.

shelving position

Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

When removing an oversized book from the bottom of a stack, the books on top should be removed one at a time, and afterward put back in the same manner.

removing a volume

3. Opening new books

Careless opening of a new book, or a newly bound book, can crack its **spine**. Books bound in plastic are especially prone to having tight **spines**. All staff who need to open a tightly bound book, and most especially staff engaged in cataloging, where the book must be opened for examination of content, should use the proper technique to encourage the book to open easily.

With the book on its **spine** on a flat surface, and the **text block** held upright, open the front cover and run the fingers gently along the **hinge**. Do the same to the back cover, followed by both front and back **end sheet** pages. Then, altering front and back until the entire **text block** is completed, open small sections of pages, applying the same gentle pressure along the **hinge** while holding firmly the remaining **text block** in an upright position.

method of opening

D. HANDLING MATERIALS DURING PROCESSING

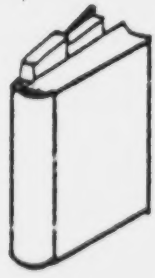
All staff should be aware of books as physical objects and be concerned that no processing routine or practice interferes with the preservation of these items and accessibility to the information they contain. The more staff members know about proper care and handling of books, the less accidental damage occurs.

Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

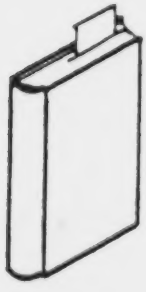
1. Inserts

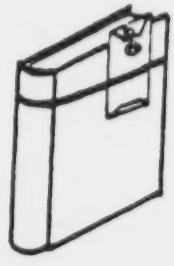
Various kinds of enclosures are inserted into books going through processing and often these enclosures collect into packets that become quite thick or bulky. Jamming packets of cards, order forms, invoices, flags, etc., inside the cover or text block of a book, tightly against the hinge, can strain or break a binding which has been custom made to fit the thickness of the book's text block.

bulky packets



A thin packet may be placed in the center of the text block, away from the inner margin. Thick or bulky packets should be placed as appropriate between, on top of, or in envelopes alongside of the books to which they relate.





Definitions for terms bold-faced in the text can be found in the GLOSSARY at the end of this manual.

2. Detachable sheets in books being bound

detachable sheet to hold processing instructions

Books going through the binding process require attachments of order and binding forms as well as colored sorting codes in many cases. Such attachments and permanent markings should never be placed directly onto the pages of the book. Instead a separate acid-free sheet of paper, gummed and perforated along one long side, is inserted and attached in the front of each book to hold such glued-in forms and sorting codes. This sheet is bound into the book.

After processing is completed, these sheets are detached along the perforated line and discarded. Any forms from this sheet which must accompany books to their final destination outside processing areas are inserted into the center of the **text block**.

3. Marking in books

pencils or labels not pens

All markings directly applied to books should be either in pencil or printed on gummed labels. If in pencil, information is to be written using a soft lead pencil, such as a No. 2, and then using only the minimum of pressure necessary for legibility. Placement of pencil marks and labels should be as unobtrusive as possible and should never obscure printed or visual information.

Pens or other similar permanent writing tools are inappropriate for marking processing instructions directly into books.

ownership stamps

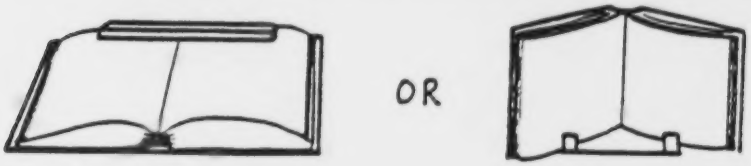
Library ownership and date received stamps should be applied with proper support given the **spines** and **text blocks** and placed so that printed and visual information is not obscured. Too much ink on a stamp can ruin a **cover** or page of a book.

Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

4. Keeping books open during cataloging

keeping books open

Although a properly bound book should open flat and remain open, many books won't cooperate and require some effort to keep them open. During cataloging or other processing activities, a **book snake**, book stand or sheet of Plexiglass should be used when it is too awkward to use just hands. Never use a weighty object such as another book because of the damaging stress which the weight exerts on the spine of the open book.



5. Office supplies

Paper clips and rubber bands are common office supplies which damage books when improperly used or left in place too long.

paper clips

Paper clips are very handy but pages of books often show signs of their use--crimped pages, tears, and rust marks. Most processing slips inserted into the center of the text block will stay there during processing if the book is handled properly. Paper clips should be used as little as possible and must be carefully removed when their function is complete. Paper clips should not be left on volumes to be placed in Twelve-Month Hold in Automated Cataloging or onto other long-term processing holds in the library.

rubber bands

Rubber bands are another problem, as they can bend or rip pages and covers. A long-term effect, as the rubber band rots, is a sticky, damaging residue remaining on the book. Rubber bands should therefore not be

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used to secure together unbound materials or books going onto Twelve-Month Hold in Automated Cataloging or onto other long-term processing holds in the library. To secure together unbound or hold materials use cotton tape (preferred) or string tied with a library knot. See page 1.15 of this manual for instructions on how to tie this knot.

Do not use rubber bands to send any materials through campus mail.

staples

Staples mutilate pages of books and should therefore never be used.

6. Uncut pages

method of cutting pages

Occasionally books arrive in the library with pages that have not been cut. For those that need to be bound, the pages will be cut before binding. For already bound books, library staff, not users, should cut the pages by holding the book partially open, and with either a metal letter opener or bone folder cutting the top and **fore edges** with very short strokes, taking care not to saw back and forth through **foldings**. Holding the **text block** flat with a free hand will help avoid uneven cutting of pages. If more than a few pages need cutting, refer the volume, after end processing, to the Book Repair Unit.

7. Photocopying

careful positioning

Photocopying can easily damage books by putting undue pressure on **spines** as they are bent back to lie flat on the glass screen. If the paper is brittle, this will crumble or break the paper at stress points.

Many machines found in the libraries are not meant to copy facing pages in bound books. When necessary therefore, photocopying should be done carefully by inverting the book, gently placing it atop the glass screen, covering the book with the machine flap, and copying. Apply no more than light pressure to the **spine**. Accept a less than perfect copy if the alternative would mean pressing books flat.

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PRESERVATION GUIDELINES FOR CIRCULATION AND STACK MAINTENANCE PERSONNEL

The General Libraries

Preservation Committee

Austin
1986

3. PRESERVATION GUIDELINES FOR CIRCULATION AND STACK MAINTENANCE PERSONNEL

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PRESERVATION GUIDELINES FOR CIRCULATION AND STACK MAINTENANCE PERSONNEL

This manual is intended to help circulation and stack maintenance staff protect the library materials they handle. The basic preservation rules contained here, if followed, will not only keep vulnerable materials available for current use, but also preserve them for use in the future.

A. THE CIRCULATION AREA

1. Book drops

frequency of unloading

While book drops provide service when the library is closed or during peak use times, they are major sources of damage to books. Circulation staff can attempt to minimize this damage by emptying the bins or rooms as often as possible. If a bin is employed, it should be carefully positioned below the book drop in order to avoid damage to books.

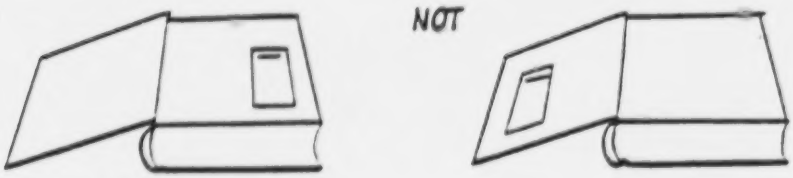
removal of books

Care should be given to the proper removal of books from bins. Gently lift a few volumes at a time, providing adequate support underneath. Do not lift by headcaps or boards or toss them in piles either in the bin or on a book truck.

2. Charge/Discharge

date due slip

When charging or discharging a book, check to insure that the date due slip is on the text side (right) of the front end sheet. If the date due slip has been placed on the inside front board of the book, relocate it if possible to the correct position.



Definitions for terms bold-faced in the text can be found in the GLOSSARY at the end of this manual.

If that is not possible, hold the book on its spine with the **text block** vertical and front **board** flat on the desk when stamping.

In the case of items in laced-on or glued-on pamphlet bindings, the date due slip may be placed on the inside back cover.

If the front **end sheet** contains decoration, maps, illustration, or special bookplates, the date due slip should be put on the first blank sheet after the front **end sheet**, on the text side.

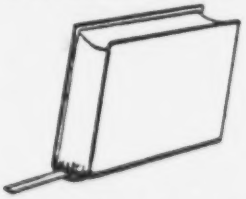
When sensitizing or desensitizing books, handle each individually and carefully to avoid the wear and tear resulting from rough quick handling.

Remove papers and bookmarks inadvertently left in books.

2. Placement of security strips

Generally, security strips should be placed in the **hollow** of the book **spine**, with care taken to insure that they are

inserting strips



not jammed between the **sewing** and the **super**. If the book has a **tight back**, is paperbound, or is in a pamphlet binder, a two-way adhesive strip should be used. If the volume has potential value as an artifact, the appropriate bibliographer should be consulted before a strip is inserted.

Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

If it is necessary to use two-way strips, insert them between pages (preferably blank pages) as close to the inner margin as possible to avoid loss of text. Two-way adhesive strips must never be inserted between pages where either the text or an illustration is printed across the margin.

strips between pages

4. Problem books

Some categories of problem books are easily identified and should be put aside for review by bibliographers or supervisors. Damaged books, such as those with loose hinges where the text block sags, with severe water damage, with damaged or loose spines or covers, and with loose pages are some of these obvious categories.

damaged books

Refer collections of loose plates, inadequately secured, to a bibliographer or supervisor who will decide what to do with them.

loose materials

Potentially rare or valuable books, especially those in a state of disrepair, should also be referred to a bibliographer or supervisor.

rare books

B. TRANSPORTATION OF BOOKS

Handle and transport books carefully. Improper loading and removal of books from book trucks is one of the most frequent causes of damage to library materials and potentially the most preventable if stack personnel learn proper handling and transportation techniques.

1. Hand carrying

When hand carrying books, carry moderate, manageable armloads.

hand carrying

2. Book trucks

Place books on trucks in an upright position with no other materials stacked on top of them. If a shelf of a truck is only partially full, keep books vertical with a book end or with a group of books laid flat to support the others. Do not place them on their fore edges even for a short period of time, as for example when arranging them in call number order, since this

book position on truck

Definitions for terms bold-faced in the text can be found in the GLOSSARY at the end of this manual.

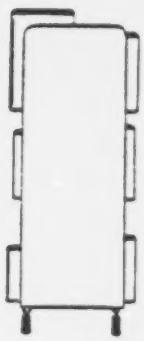
NOT

can cause the body of a book to come loose from its covers.

Large folio volumes should be placed flat on a shelf.

Two other important points to remember when loading a truck are not to overload it and to evenly distribute the weight. Do not jam books too tightly on the shelf. Even, balanced distribution and normal-sized loads make the truck easier to manage and prevent it from tipping over.

balancing weight on trucks



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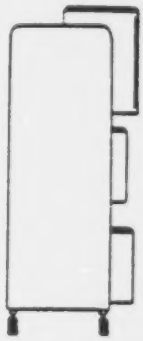


Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

Move book trucks carefully on and off elevators, around corners, and in narrow passages, paying special attention to any material which may be portruding. Let your supervisor know if an elevator is not stopping evenly or if a truck seems wobbly or unstable.

maneuvering trucks

Refer also to section C., SHELVING.

3. Unloading book trucks

Many of the above instructions should also be followed when unloading. Refer also to the next section on shelving.

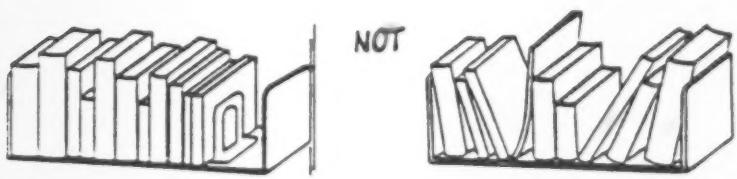
C. SHELVING

It is essential that staff be well informed about proper book handling and placement. In addition to contributing to the conservation of library materials, well-ordered stacks and proper handling techniques serve as a positive example for library users and form the basis for the education of users on the preservation of materials.

1. Position and placement of books

Place a book on the shelf so that it stands vertically and upright and is gently supported by the books on either side, additional support being supplied by book ends. Books should not be shelved too loosely. They can be permanently bent or splayed if this is done.

proper position of books



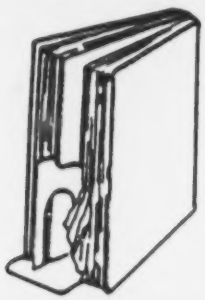
Jamming books too tightly on the shelf should be avoided. Overcrowding can create problems in the easy removal of books from the shelf. Binding damage can also result.

overcrowding

Definitions for terms bold-faced in the text can be found in the GLOSSARY at the end of this manual.

book ends

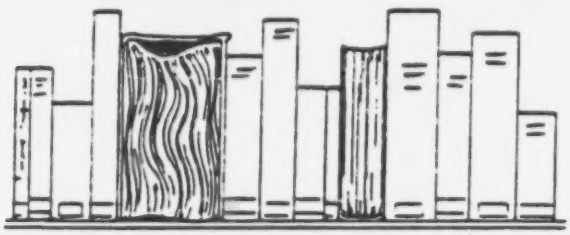
Library book ends should be free of sharp or rusty edges. When possible, they should support over half of the height of the book and should have a wide profile. When shelving near a book end be careful not to accidently "knife" the pages of the book with



the edge of the book end. Report book end problems to your supervisor.

fore edge shelving is wrong

Fore edge shelving is unacceptable since it can cause the book block to loosen from its case. If a volume is too tall to shelve vertically, it is preferable to shelve it on its spine rather than on its fore edge.

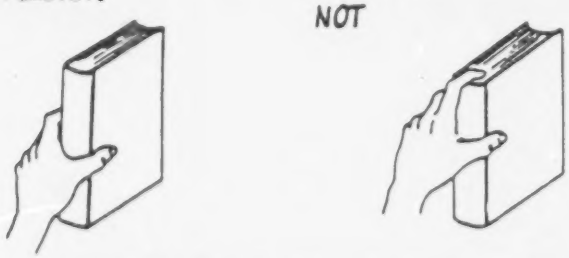


If separate shelving for oversized materials exists, consider having the volume recataloged for the oversized area.

removing a book

When removing a book from the shelf, never pull it by the top of the spine, since this might cause headcap damage. Rather, the two adjacent volumes should be pushed back slightly in order to grasp the book firmly for removal.

NOT



Definitions for terms bold-faced in the text can be found in the GLOSSARY at the end of this manual.

Whenever possible, avoid shelving books on the top shelf. If library space constraints require that the top shelves be used, always use a kick stool in order to avoid damage in the placement and removal of books.

use of top shelves

Ideally, each shelf should remain at no more than 75% of capacity in order to provide for collection growth and to avoid the book damage often resulting from overcrowding. Routinely alert your supervisor to overcrowding in the stacks in order that plans for necessary shifting can be made.

shelving for collection growth

2. Oversized volumes

It may not be possible to stand oversized volumes upright or to provide separate oversized shelving areas in all libraries. If this is the case, oversized volumes should lie flat, no more than three deep on the shelf, on shelves deep enough to support them, or they should be shelved on their spines. Very large tomes, such as those found in art studies, should always be shelved flat.

shelving position

When removing an oversized book from the bottom of a stack, the books on top should be removed one at a time, and afterward put back in the same manner.

removing a volume

D. CARE AND MAINTENANCE IN THE STACKS

This section is directed at unit supervisors as well as stack maintenance staff. The supervisor needs to arrange for necessary supplies, services or use of equipment and consult with bibliographers when appropriate. Keeping the stack areas clean and functional often involves the collaborative efforts of staff from many areas of the library as well as custodial and maintenance staff.

1. Vacuuming and dusting

Dirt and dust are very damaging to library books. They can abrade volumes, therefore causing mechanical as well as chemical deterioration. If possible, the stacks unit should borrow a vacuum cleaner with a hand-held cleaning head for periodic vacuuming projects.

vacuuming

Definitions for terms bold-faced in the text can be found in the GLOSSARY at the end of this manual.

When a vacuum cleaner is not available, books can be cleaned quickly and easily with a One-Wipe brand dustcloth, which is chemically treated to pick up dirt. Feather dusters in most cases only stir up the dust, without removing it. Care should be taken not to rub the dirt on the book's edge into the **text block**. Use a light stroke which runs parallel to the edge.

The frequency of vacuuming and dusting will be dependent upon the size of the collection and the size of the staff able to do the work.

2. Regulating environment

facilities problems

Be alert for environmental factors which might be harmful to books. Leaky pipes, water stained ceiling tiles, excessive room heat, and unshaded windows that result in direct sunlight on the books should be brought to the attention of the stacks supervisor.

insect damage

Roaches, silverfish, and other insects can be a problem in libraries. If insect damage becomes apparent, the supervisor should arrange through Facilities and Support Services for an exterminator to come. Alert your supervisor when insects are observed in book areas.

3. Maintaining equipment

loose shelving

Shelves and their bracing should occasionally, at least annually, be checked for looseness. Some shelving arrangements are kept at tension by diagonal guys which have a tendency to loosen over time, causing shelves to sag or lean.

4. Problem books

damaged books

Some categories of problem books are easily identified and should be put aside for review by bibliographers or supervisors. Damaged books such as those with loose **hinges** where the **text block** sags, with severe water damage, with damaged or loose **spines** or **covers**, and with loose pages are some of these obvious categories. Consult your supervisor on how to handle damaged volumes you find in the stacks.

Definitions for terms **bold-faced** in the text can be found in the GLOSSARY at the end of this manual.

Refer collections of loose plates, inadequately secured, to a bibliographer or supervisor who will decide what to do with them.

loose materials

Potentially rare or valuable books, especially those in a state of disrepair, should also be referred to a bibliographer or supervisor.

rare books

E. REPAIR

The General Libraries Book Repair Unit is responsible for making major repairs to library materials. Many units, however, have one or more staff members who can do the following minor repairs:

- Page mends using heat-set tissue
- Some tip ins (if only a page or small group of pages is loose and the spine is still intact)
- Minor repairs to the covers, such as strengthening a frayed or torn edge or corner. (Book tape is used for this purpose.)

minor repairs in unit

Only individuals first trained in the Book Repair Unit should be making these repairs. All other repairs should be referred to central Book Repair.

major repairs to Book Repair

GLOSSARY

Board - The hard part of the book cover. The book has a front and back **board.** (See illustration, page 3.12.)

Book block - see **Text block**

Case - The **cover** of a case-bound book. A book is case-bound when the **cover** is made separately from the **text block**, and later attached to it by means of **end sheet** and **super.**

Cover - see **Case**

Endpaper - see **End sheet**

End sheet - A sheet of durable paper, half of which is glued to the inside of the **cover**, and the other half of which is free, making a page. The **end sheet** is the first thing one sees when one opens the **cover.** To it are usually affixed the coding and date due slip. (See illustration, page 3.12.) Also called **endpaper.**

Folio - The largest size of book, with a height of over 18 inches.

Fore edge - The edge of the book opposite the **spine.** (See illustration, page 3.12.)

Headcap - The top of the **spine.** (See illustration, page 3.12.)

Hinge - The juncture of the **spine** and **boards** of a case-bound book.

a. **Torn hinge** - The book cloth has torn along the juncture.

b. **Loose hinge** - The book cloth has come unglued from the **super**, or the **end sheet** and **super** have come unglued from the **board.**

c. **Broken hinge** - The **board** has entirely separated from the **text block.**

Hollow - The space between the **spine** and the **super.** When one opens a book at the middle, the **spine** will stand away from the inwardly flexing **text block.** The space created is called the **hollow**, and security strips go there. (See also **tight back.**)

Inner margin - The margin of a printed page which is nearest to the fold of the section. Also called the gutter margin.

Plate - An illustration. A piece of paper with a picture on it.

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Sewing - The thread that holds groups of folded sheets together to make a book.

Spine - The edge of the book that faces outward when the book sits on the shelf. The backbone of the book. (See illustration, page 3.12.)

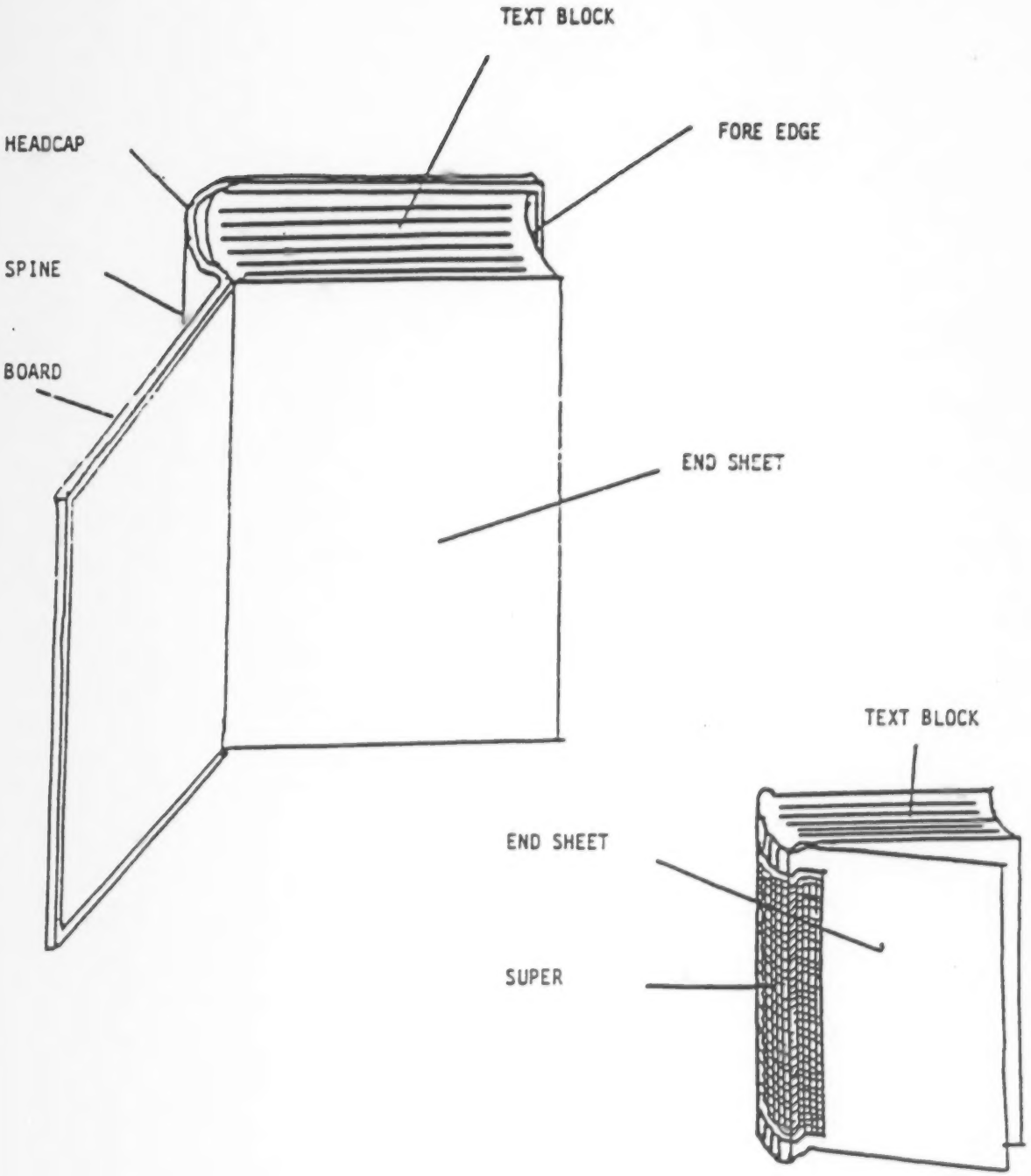
Super - Unbleached cotton mesh, or muslin cloth, glued over the sewing of a book, and covering part of the end sheet near the spine. (See illustration, page 3.12.)

Text block - The part of the book formed by its pages. The text block is attached to the cover by means of the end sheet and super. (See illustration, page 3.12.)

Tight back - A book without a hollow whose spine is glued directly to its sewing, so that the entire spine flexes inward when the book is opened. Security strips for books with tight backs must be of the two-way adhesive variety and must be placed between two pages of the volume.

Tip in - A page or pages inserted or reinserted into the text block by being glued to the inner margin.

PARTS OF A BOOK



NORTHEAST
DOCUMENT
CONSERVATION
CENTER

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TECHNICAL LEAFLET

General Preservation

WHAT AN INSTITUTION CAN DO TO SURVEY ITS OWN PRESERVATION NEEDS

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August 1991

WHAT AN INSTITUTION CAN DO TO SURVEY ITS PRESERVATION NEEDS

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INTRODUCTION

Paper is particularly vulnerable to mishandling, and to damage by environmental agents like temperature, humidity, and light. In many collections the problem of deterioration has been solved almost entirely by conservation treatment on an item-by-item basis—in part because the need to stabilize important artifacts or to restore a specific object for exhibit was a clearly defined priority.

In the past ten years libraries, archives, and other institutions have become convinced that comprehensive long-range planning offers the best protection for materials in their care, and that a systematic plan maximizes the use of limited funds for preservation. This guide has been produced to help librarians and archivists with limited preservation experience design a program to ensure that collections of enduring value survive as long as possible in usable condition.

NEDCC believes the most effective preservation efforts focus on ways to prevent ongoing deterioration (such as light damage or acid formation) in books and paper. This is analogous to the strategy of freezing wet books and paper as soon as possible after a library disaster—it prevents additional damage to a large quantity of affected material, and it buys time to make reasoned decisions about individual objects.

Our expanding preservation knowledge is reflected in the growth of new technologies and the swelling preservation literature. Information may be overtaken by events before it is published: that caution applies here as elsewhere. Important developments are occurring in mass deacidification, in the use of alkaline paper, and in non-traditional information media. These strategies are omitted from this guide for several reasons.

All current mass deacidification technologies present serious drawbacks in engineering, efficiency, safety, or environmental impact. The future is promising, but research is still underway. In addition, while the neutralization of acids and the deposit of an alkaline reservoir will virtually halt acid decay in appropriately stored books and paper, they will not make brittle paper white and supple again. Mass deacidification is a protective treatment for new books and paper rather than a restorative for past damage.

There is great merit in the push to use alkaline paper for written and printed materials that may come to have enduring value. A number of legislative initiatives seek to preserve future government records by this strategy. Unfortunately the need to preserve some books and records may be at odds with environmental management concerns: much of our country's trash is paper-based, and must decay readily. No reliable estimates of the amount of paper required for short-term applications vs. enduring records seem to be available. Librarians, archivists, and historians continue to debate guidelines for predicting the long-term importance of various sources of information.

Computerized media are becoming steadily more sophisticated, and may eventually reproduce historical as well as contemporary information. Technologies such as optical disk and machine-readable formats are tremendously efficient access tools, but their durability is still unknown.

Research shows that even badly deteriorated material can be protected from further decay if it is stored in appropriate enclosures in a suitable environment. The best way to preserve library and historical collections is to control light, temperature, relative humidity, and air quality; to provide routine housekeeping; and to use good storage and handling techniques. Protection from fire, water, and theft is also important at this level.

A second proven broad-based strategy for preservation is reformatting (e.g. microfilming or photocopying) fragile, damaged, valuable, or much-used items. Frequently this occurs in cooperative efforts which expand the availability of information resources. Microfilm is a good solution for many kinds of records; photocopying onto permanent durable paper is useful for others, including many newsclippings and photographs. Library binding can be considered for some materials.

The third approach to preservation is the conservation of individual objects like manuscripts, journals, maps, and drawings. Since treatment is the most time-consuming and expensive strategy on a "per object" basis, most libraries choose to treat unique or valuable artifacts.

A good library preservation program uses all three methods. Improvements in the environment benefit every item in a collection, so we tend to emphasize these. In making decisions about what to do first, I believe the most important questions are these: (1) what will have the greatest impact on the largest number of objects; (2) what is really possible in your institution; (3) what action will have the greatest visibility (and the greatest effect on future funding or public interest); and (4) does this decision have any potential for damaging any objects in the collection?

This particular guide was written with libraries and archives in mind, but paper is ubiquitous in historical collections, including, as it does, everything from manuscripts to wallpaper, fans to artworks (two- and three-dimensional). Many collections contain photographs, parchment and vellum, and other cultural artifacts that are not conventionally paper-based. All are vulnerable to adverse storage and exhibit conditions and poor handling, and we believe that the principles outlined here can be transferred to a number of contexts.

The manual contains material originally published elsewhere; this is reprinted with permission, and sources are identified. These resource materials are essential. They are included to give preservation planners a sample of the available information and a starting point. The manual is not an end in itself--it is important to read further in the areas of preservation that intrigue you or are critical for your institution.

Surveys: Why, What, and How?

One of the first steps in creating a systematic preservation program is to assess conditions collections, and policies. How does a library make such an evaluation?

General surveys identify preservation goals and priorities. A thorough survey examines building conditions, policies, collections, and storage and handling procedures. Each building should be inspected from roof to basement, outside to inside, and room by room. Ideally, knowledgeable staff members in each department should be interviewed. At the end of the survey, a surveyor should be able to:

1. Identify potential hazards to the collection;

2. Prioritize areas of the collections for preservation action, distinguishing between artifacts and informational or limited-lifespan materials;

3. Identify preservation actions required to keep collections in the best condition possible for the longest time possible (examples include extending security, improving housekeeping, installing climate-control equipment, replacing poor enclosures, conservation treatment);

4. Prioritize the needs of the collections and identify steps necessary to achieve the required preservation actions.

Where to Find Help

Consultation: While the pool of experienced surveyors is still small, a number of programs provide professional assistance, many of them under generous funding from the National Endowment for the Humanities. Advice and help are available from:

1. The Northeast Document Conservation Center, 100 Brickstone Square, Andover, MA 01810-1428 (508-470-1010)

2. The American Institute for Conservation, 3545 Williamsburg Lane, Washington, D.C. 20008 (202-364-1036)

3. American Association for State and Local History, Suite 102, 72 Second Avenue North, Nashville, TN 37201 (615-255-2971)

4. American Library Association, 50 E. Huron Street, Chicago, IL 60611 (312-944-6780)

5. American Association of Museums, 1225 Eye Street, N.W., Washington, D.C. 20005 (202-289-1818)

6. Society of American Archivists, Suite 504, 600 S. Federal Street, Chicago, IL 60605 (312-922-0140)

7. State libraries, state historical societies, major museums, regional conservation centers, and professional conservators

While a consultant can provide an objective viewpoint, and is often seen by library administration as having special credibility, a staff member brings important knowledge of the institution's values, conditions, and functions to the survey process. As long as the surveyor can suspend assumptions about an institution's capabilities, and can look open-mindedly at issues that may have been ignored for years, an in-house survey can be very effective. Such a survey will usually be part-time, so it may take longer, but it can pay great attention to detail and involve the whole staff actively.

Literature: Several bibliographies are included in the resource materials. In addition, two recent annotated bibliographies provide an overview of the available printed information. These are "A Two-Year Perspective on Library Preservation: An Annotated Bibliography" [Lisa Fox, Library Resources and Technical Services 30 (3):290-318 (July/Sept 1986)] and "Library Preservation in 1986: An Annotated Bibliography" [Carla Montori, Library Resources and Technical Services 31 (4):365-385 (Oct/Dec 1987)]. The American Library Association, the Society of American Archivists, and the Association of Research Libraries Office of Management Studies also publish useful information on preservation issues.

Audiovisual Resources: The body of slide tapes, films, and videotapes on preservation subjects is growing steadily. The only lending program currently equipped to handle national requests is in the Office of Museum Programs, Arts and Industries Building, Room 2235, Smithsonian Institution, Washington, D.C. 20560. Contact that office for a list of available material. The lending program of the Library of Congress has been discontinued due to budget cutbacks and staff shortages. For further information contact the Preservation Program Office, Library of Congress, Washington, D.C. 20540.

Conservation Administration News expects to publish a guide to available audiovisual resources of interest to preservation planners. This is in preparation under the guidance of Susan Swartzburg, preservation librarian for the libraries of Rutgers University. Please contact Robert H. Patterson, Editor, CAN, McFarlin Library, University of Tulsa, 600 S. College Avenue, Tulsa, OK 74104 for additional information.

What Comes Next?

This guide provides an outline of the information gathered in a professional survey, along with basic knowledge needed to interpret observations and find solutions. It draws on a number of sources, including the 1982 edition of the Conservation Survey Manual; the survey protocol designed by George Cunha, Director Emeritus of the Northeast Document Conservation Center (NEDCC); writings on the subject of library binding by Jan Merrill-Oldham; and the experience of the NEDCC and Southeastern Library Network (SOLINET) survey programs under Millie O'Connell, Karen Motylewski, and Lisa Fox.

The following questions, the accompanying background information, and many of the articles included in the

resource section form the basis of NEDCC survey reports. This is not an exhaustive guide, but a review of the most significant factors affecting the condition of collections with enduring research, cultural, or historic value. A thorough examination of these concerns will usually lead to other useful observations. Much of the survey process is common sense, and a good building evaluation draws on experience that most home-owners already have.

It is important to complete the survey process by writing a formal report outlining observations, recommendations, and possible solutions. This report will help organize your understanding of an institution's preservation needs, and will help prioritize necessary actions. It will provide guidance for preservation planning in the long term, and may serve as the basis for applications for funds to implement improvements or to treat objects in the collections.

In developing a preservation plan, remember to set short-, medium-, and long-term goals. Some actions can be implemented immediately, while others may require diplomacy, education, and funding. If setting priorities proves difficult, contact a colleague who has implemented a preservation program, or contact one of the agencies listed for assistance. Sometimes it simply helps to talk about your concerns.

If preservation problems seem overwhelming, choose one concrete starting point. Possibilities include:

1. providing shades or other light protections;
2. moving collections at least 4" from the floor in all areas;
3. cleaning stacks and other storage areas;
4. writing an emergency-preparedness plan and stocking basic supplies for quick response;
5. photocopying a much-used photograph collection and sleeving and boxing original prints.

Every improvement will contribute to the survival of collections.

SURVEYING YOUR OWN INSTITUTION: WHAT DO YOU NEED TO KNOW?

I. THE BUILDING

The building is the outermost shell protecting collections: it is the first defense against the impact of weather, pollutants, and water. Maintenance of gutters, drains, building fabric, and foundations is an investment in controlling interior conditions as well as preserving the building itself. This guide will not try to provide a detailed understanding of construction practices, architectural structures, climate-control equipment, and environmental phenomena. The prospective surveyor who feels the need for a good introduction to these subjects is referred to basic guides for the home-owner (e.g., the Time-Life series or America's Handyman Book, New York: Charles Scribner), and to Garry Thomson's The Museum Environment (2nd edition, Boston: Butterworths, 1986).

Form A (see resource materials) can be used to summarize observations about the building in general.

A. Characteristics of the Building

1. What are the predominant materials used in the construction of the building (e.g. wood frame, masonry, steel and poured concrete)?

2. How old is the building? Have additions or renovations been made? When? Has the building been well maintained?

   a. Are exterior surfaces and finishes intact (e.g. are shingles intact and in place, is paint blistered, has mortar deteriorated, are there accretions on masonry that point to water or condensation problems)?

   b. Are walls in the original plane? Are there any significant cracks or gaps in exterior walls or joints?

   c. Is here evidence of leaks around windows or on interior walls? Are caulking and other seals intact?

   d. Is the building artificially insulated at any point? Where, and with what?

3. What is the condition of the roof and drains?

   a. Is the roof flat or pitched?

   b. What is the roof covering? Are there any signs of damage (e.g. cracking, buckling, deteriorated flashings)? How old is the roof? (Most modern roofing materials have an anticipated life-span of no more than 20 years.)

   c. Is the roof inspected and repaired regularly? How often, and what is done?

   d. How does the roof drain? Are gutters and drains well attached, in good condition, and functioning? Are they cleaned routinely? Do drains channel water away from the building?

   e. Does water accumulate on the roof or at the foundation?

   f. Are there skylights? Are seals or caulking deteriorated?

   g. Is there a history of leaks, or are there evidences of leaks inside the building? Where, and

what?

4. What is the structure and condition of the foundation?

   a. Are there cracks or other signs of deterioration?

   b. How is the foundation sealed? What drainage is provided at the footings of the building? Are these effective?

5. Condition of attic, basement, and storerooms:

   a. Which of these does the building have? Are collections stored in any of these spaces?

   b. What condition are they in? Are they clean, or cluttered and dirty?

   c. Is the cellar wet or dry? Are the basement and/or attic equipped with any climate-control equipment? Fire detection and security equipment?

   d. Is there any history or evidence of rodents, insects, mold?

II. THE BUILDING ENVIRONMENT

One of the two most important factors in the preservation of books, paper, and photographs is their storage environment. There is still controversy over ideal conditions, but there is agreement that high temperature and relative humidity are destructive, and that stable conditions are extremely important.

A formal monitoring program should record temperature and relative humidity in any institution with collections of long-term value. We now recommend as a minimum that institutions choose a temperature below 70°F and a relative humidity between 35-50%, to be maintained ±3°F and ±5% RH 24 hours a day and 365 days a year. Cooler temperatures are desirable, and climate-control equipment should not be lowered or turned off when buildings are unoccupied. "Monitoring Temperature and Relative Humidity: Creating a Climate for Preservation" (see resource materials) provides additional information about monitoring and climate recommendations.

If costs are a concern, winter heat should be maintained at the lowest level the staff will tolerate. If the temperature of storage areas is significantly lower than use areas, provisions must be made to allow time for gradual equilibration for materials brought out of storage. This will protect them from shock, condensation, and potential water damage.

It is important to evaluate the building's capacity to tolerate major changes in temperature or relative humidity. In some cases, changing the interior climate can pose a threat to the fabric of the building. Properly installed insulation or vapor barriers can mitigate such problems, but sometimes it will be necessary to consider relocating collections to another building.

Good air circulation is important for even climate distribution, the removal of pollutants, and mold control. An effective filtering system is important. Particulate material can dirty and abrade paper, and common gaseous pollutants combine with atmospheric moisture to create acids that attack paper. Wooden storage furniture, many contemporary construction materials, and some paint films produce pollutants (such as formaldehyde) that are destructive to paper and photographs.

A qualified consultant can be extremely helpful in analyzing building needs and climate-control systems. Choose an engineer with experience in evaluating systems for historic structures and collections-holding institutions, and ask for reference clients with needs similar to yours. Then make sure those references were satisfied with the

service they got.

All light is a source of energy for destructive processes in paper. We emphasize protection from the ultraviolet component in natural and fluorescent light because it has a high activation energy and can cause rapid damage.

A. Temperature and Relative Humidity

1. Are there provisions to maintain constant temperature and humidity throughout the areas where collections are housed, 24 hours a day, 365 days a year?

2. Is there a program and procedure for monitoring this environment on a regular basis? What equipment is in use? Is the equipment regularly calibrated?

3. What machinery is used to control temperature and relative humidity? If the building is air conditioned, does machinery include humidifiers and dehumidifiers? Do they work?

4. If climate control machinery is in use, what is the target temperature and relative humidity? What are the normal levels?

5. If there is no provision for year-round, dependable close control of temperature and humidity, what are the prevailing conditions in the summer? In the winter? During transition periods in spring and fall?

B. Pollution

1. Is there a mechanism for air circulation throughout the building? Are vents blocked by furniture or collections? Does air circulation seem to function effectively?

2. Does the location of the intake for building air replacement force it to take in avoidable pollutants (vehicle exhausts, building exhausts, laboratory chemicals)?

3. Is the air circulation system equipped with filters? To what level of protection? Do they filter particulate material, or particulates and gases?

4. Are all filters changed regularly? How often? By whom?

5. Is there dust in the collections areas? An evenly distributed coating of dust suggests inadequate filtration.

6. Have partitions or storage furniture been constructed of materials such as particle-board or plywood? Are large amounts of the material present? What coatings have been used on these materials? Have these materials been tested for formaldehyde or other emissions?

C. Light

1. What are the sources of natural light in collections areas?

2. How is sunlight entering the building controlled to minimize intensity and remove ultraviolet radiation? Are shades, curtains, or blinds shut when sunlight is direct? At closing?

3. What type of artificial lights are used?

a. How bright is the light? 200 lux is considered optimum for light-tolerant materials; 50 lux is recommended for light-sensitive materials, including many paper artifacts.

b. If fluorescent lights are used, are they shielded to filter ultraviolet radiation? Do their ballasts constitute a fire-hazard?

c. Are lights turned off when collection storage areas are unoccupied?

D. Pests

1. Is there any history of insects, rodents, or other pests in the building? What? Is the infestation under control?

2. Is food and drink prohibited in collections areas?

3. If food is consumed in the building (by staff in offices or a staff room, or during special events), is a closed container provided for garbage, and are staff instructed to use it?

4. Is garbage removed from the building daily? Immediately following parties that include food?

5. Is extermination done routinely? What is used? Is it effective? Is it necessary? Is the institution knowledgeable about integrated pest management strategies?

II. PROTECTION OF COLLECTIONS FROM SUDDEN LOSS

Paper-based collections are highly susceptible to damage from water and concomitant mold. Collections should never be stored near or beneath water sources like radiators, bathrooms, and kitchens. All materials must be raised at least 4" from the floor on shelves or pallets to avoid damage in a flood. Basements often pose a significant water threat.

Preservation efforts are moot if collections are lost to theft, fire, or other vandalism. Since an estimated 70% of library fires are arson-related, dependable 24-hour security is essential. An automatic fire detection system with a 24-hour monitoring system is also critical for collections of enduring value.

Good control of access protects patrons, staff, and collections. No repository should use a master key system. Keys should be limited to staff with a demonstrated need to have them, and a formal key-control system should be in operation. Good supervision is essential to protecting collections from theft and damage.

A. Water

1. Where are bathrooms, sinks, kitchens, and other plumbing, and where are collections in relation to them?

2. What climate-control equipment is in use? Air conditioners, humidity controls, and some heating systems are all sources of water. Where are these, and where are their pipes in relation to collections?

3. How old is climate-control equipment? Is it well maintained? Are pipes inspected for signs of corrosion, failed seals, or other damage? Is there any history of plumbing or other leaks?

4. If collections must be stored where they are vulnerable to water damage, is there a 24-hour water alarm system in place?

5. Are all collections at least 4" above floor level in all areas?

B. Security

1. What kind of intruder alarms are installed? Are these connected to a 24-hour monitor?

2. How are access to the building and collections controlled?

3. How are use and distribution of keys controlled?

4. Where are collections of enduring value to the institution located? Who has a key to this area? Who can access this area during working hours?

5. Are researchers asked for positive identification? Are written records of visitors and use of materials maintained?

6. Are materials of special value counted out for researchers, returned, and checked by staff before additional materials are issued?

7. Are all researchers in view of a staff member at all times? Are tables and desks positioned to provide optimum supervision by staff? Are researchers ever left unsupervised when they are using valuable materials?

8. Has a staff member been assigned responsibility for security management?

9. If there is a bookdrop, how is it secured against vandalism or arson? Does it open into the building? Could it be eliminated?

C. Fire Prevention

1. What type of fire detection devices are installed? Are they connected to a 24-hour monitor? Are they regularly maintained and tested? What would the speed of response to an alarm be?

2. Has the staff or a fire-safety professional evaluated wiring, storage practices, and other factors in the building for fire safety according to guidelines established by the National Fire Protection Agency (see NFPA Publications No. 910 and 911, Batterymarch Park, Quincy, MA 02269)?

3. Is automatic fire suppression installed? What is the equipment (e.g., halon, sprinklers, other)? If sprinklers, are they wet or dry pipe? What is the activation temperature? Do heads discharge individually? Is there a sensor to automatically stop the flow when the fire is extinguished? How would an accidental discharge be detected and controlled?

4. Are portable extinguishers available? Where? What type? Has staff been trained to use them?

5. Is there an evacuation plan? Are fire drills held?

6. Has the institution had an inspection of the building, extinguishers, detectors, and suppression system within the past year?

D. Disaster Planning

1. Does the institution have a written disaster plan? Has it been updated within the last year?

2. What is the history of natural (e.g. flood, hurricane, range fire, earthquake) or man-made (e.g. water main failures, gas leaks) emergencies in the vicinity of the institution?

3. Are basic supplies for emergency response (e.g. polyethylene sheets, sponges, paper towels) on hand and reserved for this use?

4. Who would provide services, facilities, or equipment if the institution needed emergency electricity, freezer space, vacuum freeze drying, space, or manpower for air drying wet collections?

5. Are duplicate library shelflists and computer records or card catalogs kept off-site?

6. Has staff identified salvage priorities for the collections in the event of a disaster? Does the fire department know these priorities?

7. Have staff responsibilities for disaster response been assigned, and does everyone know their role?

8. Are collections insured against disaster damage? What would the insurance pay for (labor, vacuum freeze drying, conservation, freezer space)? Are collection records current, and detailed enough to satisfy the insurer?

IV. INDIVIDUAL STORAGE AND EXHIBITION AREAS

Individual spaces should be evaluated, and many of the questions that apply to the building as a whole are applicable (e.g., climate, light sources, leaks, etc.): do building-wide observations include this space, and does this space conform to those observations? The following questions should lead to additional pertinent observations. Form B can be used as a reminder of major concerns of a surveyor at this point.

A. Temperature and Relative Humidity

1. What is the normal temperature and relative humidity in each space?

2. How are these monitored?

3. Does available climate-control equipment serve every area where collections are stored?

4. Is any area atypically hot or cold, damp or dry? Why?

B. Pollution

1. How are dust and other pollutants controlled? Is there significant dust on collections or furniture? Are page edges significantly more discolored or brittle than their centers? (This suggests a high level of pollutants.)

2. Is there a well planned and supervised housekeeping program? What does it include? Who does the work? Who supervises it and maintains quality?

3. What are storage spaces like—clean, dusty, dirty, cluttered?

C. Light

1. What artificial lighting is used? If fluorescent, is ultraviolet radiation filtered? What are light levels?

2. What are the number, type, and size of windows? What direction do they face? Are there provisions for filtering ultraviolet radiation? Reducing the intensity of light? Excluding direct sun?

3. Is there evidence of light damage to collections (e.g. faded media, yellowed paper, faded bindings or spines)?

D. Insects, rodents, mold

1. Have any of these been seen in these collections? Where?

2. Are there any signs of pest damage (e.g. droppings, shredded paper, stains or destruction in bindings or paper)?

3. If there is a history of mold in this space, have the leaks or climate conditions responsible been corrected?

4. Are housekeeping procedures adequate to control the threat of pests?

E. Water Sources

1. Where are steam and water pipes relative to collections?

2. Is there any evidence of leaks on walls or ceiling? Evidence of previous water damage (e.g. stains, efflorescence, plaster damage, mold), especially in basement and attic areas?

3. If there are known water hazards in this space, is an alarm system in place?

4. Are all collections in this space at least 4" above floor level?

F. Security

1. Are researchers allowed in any unsupervised storage area?

2. Is there any area of the stacks or research areas where visitor activities cannot be observed?

3. Does everyone who has a key to the space need one?

G. Fire Protection

1. Is wiring adequate for the equipment in use? Is there any history of blown fuses or electrical failure in this space?

2. Is the space equipped with smoke or heat detectors? A portable fire extinguisher? Automatic fire suppression?

H. Furniture

The choice of storage furniture is important for the preservation of historic collections. Most currently

available choices contain materials that give off by-products that can react with paper chemistry.

Standard metal library shelving with a baked enamel finish is recommended for the storage of important book collections. Since paint films frequently contain free formaldehyde, a source of formic acid, it is important for the buyer to require manufacturing specifications (e.g., appropriate paint-processing temperatures and venting) to insure low formaldehyde emissions, and to include them in purchasing contracts where possible.

The ideal choice for boxed collections like photographs, documents, pamphlets, and works of art on paper is probably chrome-plated steel shelving. Anodized aluminum storage furniture is now coming onto the market (e.g., Crystalizations Systems, Inc., Bohemia, NY, 516-567-0888).

Wood has been the traditional material for shelving for reasons of aesthetics, economy, and construction ease. Unfortunately, most wood contains materials that are potentially damaging to paper. Curing and finishing processes introduce additional reactive chemicals. Wood products (for example plywood and particle board) contain ubiquitous urea-formaldehyde-based resins that produce formic acid in the presence of oxygen. Consequently the air around wood, particularly where temperature and humidity are poorly controlled, or where there is limited air exchange, is a source of damage for paper.

It is sometimes possible to purchase construction materials produced with Type 1 phenol-formaldehyde resins. These bond formaldehyde more completely, so it is not free to combine with atmospheric moisture and artifacts. Virtually all wood contains other sources of acid.

Wood can be painted with a good-quality solvent-based primer, followed by two coats of solvent-based acrylic paint (a metal-containing paint is best), or a high-quality polyurethane that has been tested for formaldehyde. Coatings should cure for a minimum of six weeks before collections are reshelved.

There is increasing evidence that such strategies provide limited protection. We do not recommend wood shelving for the storage of any unenclosed books of lasting value.

Where wood cannot be adequately coated, and where unenclosed collections must be stored, shelves and drawers can be lined with 100% ragboard or archival polyester film tacked down with 3M double-sided tape no. 415. Archival-quality boxes provide additional protection from wood by-products.

Our understanding of this problem is changing rapidly. Contact a preservation professional for the most current information before making an irreversible decision.

1. What kinds of stacks and other storage furniture (e.g. map files, compact shelving, free-standing shelves, file cabinets, microfilm cabinets) are in use?

2. Is sufficient furniture available for orderly, uncrowded storage of all collections?

3. Are shelves or cabinets large enough to support objects completely?

4. Is there good air circulation around collections?

5. Are important collections stored on wooden shelves, or in closed wooden exhibit cases or storage cabinets? What has been used to coat the wood?

6. Is there an effective barrier (e.g. archival box, phase box, polyester liner, metal-based paint) between collections and wood?

V. EVALUATING THE NEEDS AND CONDITION OF COLLECTIONS

A. Assessing Priorities

Preservation planning surveys focus primarily on the physical conditions in a repository, but this is only one aspect of preservation decision-making. Other elements include the intrinsic value of artifacts, their importance to a collection, legal and historic value, the ease and cost of replacement, and other factors that can only be identified by the collections' custodians. Wise preservation decisions can only be made when the collections are under good intellectual control– that is, when they are fully catalogued or inventoried, and when their relative value to the collections has been established.

In setting priorities, the nature and severity of existing preservation problems (whether they pertain to the building or collections) need to be evaluated, and past actions taken in the interest of preservation or conservation need to be examined for quality and effectiveness.

Preservation is expensive and time-consuming, and not everything is equally in need of this effort. Good environmental control is difficult to achieve and costly to maintain; the smaller the quantity of materials that require narrowly controlled conditions, the more manageable the problem becomes. Items of no long-term importance to the collections must be identified so that resources are not wasted on them. Items that do have significance need to be identified for special storage requirements or immediate care.

The following questions are intended to help the institution assess its priorities

1. What does the collection include? For each item, estimate and use the measurement that is most convenient (exact counts are not necessary).

Medium	Quantity	Unit of measurement (circle one, or specify)
Books (general)	____	titles - volumes
Rare books	____	titles - volumes
Manuscripts	____	items - linear/cubic ft Archives____
items - linear/cubic ft		
Serials	____	vols - titles - subscrip Newspapers____
vols - titles - subscrip Microfilm	____	reels - titles
Microfiche	____	pieces - fiche - titles
Maps	____	items
Posters	____	items
Photographs: prints	____	items - linear/cubic ft
negatives	____	items - linear/cubic ft
slides	____	items - linear/cubic f other (specify)
	____	items - linear/cubic ft
Other audio-visuals, including tapes, film, records, etc.	____	items
Art on paper	____	items

(If the collection of art on paper is extensive, it should be described in detail.)

2. What does the institution consider the most important areas of these collections? Priority may be given to those most heavily used for current activities; those that have long-term research value; and/or those that are rare, unique, or valuable.

3. Are there other special considerations that need to be applied to assessing the relative importance of materials? What?

4. What does the institution consider its most serious preservation problems?

5. What steps have already been taken to prolong the life of the paper collections? Include efforts such as upgrading supplies and storage materials, improving environmental conditions, conservation treatment, or microfilming.

B. Evaluating the General Condition of Collections

This part of the survey is not intended to provide an object-by-object evaluation, but to assess the institution's storage and handling practices, and to identify the damage most characteristic of an institution's collections. Acid deterioration, fading, and embrittlement point to climate and light problems. Torn or folded documents, damaged hinges and endcaps, rust stains from paper clips, and acid migration from poor-quality paper point to a need for improved storage and handling techniques. Careful handling and archival-quality enclosures join environmental control as critical factors in preserving paper-based collections.

In this section of a survey, the surveyor is looking for damage or handling practices (e.g. rubberbands used to hold covers together, poorly supported books, overstuffed file folders, acidic inserts in books or files) that are common in the collections. While this examination may locate individual objects that need repair or other treatment, it is most important for identifying general needs and areas of the collection in need of remedial actions--for example, the need to institute a program of phase boxing, or enclosing photographs, replacing manila folders with archival-quality folders and boxes, photocopying news clippings, or microfilming brittle books. Form C1 or C2 can be used to record these observations.

If individual objects that are important and require conservation treatment are identified, a conservator can be asked to evaluate objects identified as needing emergency care, or to provide a "collection condition survey." A collection condition survey is intended to examine a quantity of artifacts, making recommendations for treatment and estimating associated costs.

1. Is there evidence of wear and tear, soil and surface dirt, water stains?

2. Is there evidence of acid damage (e.g. yellowing, browning, embrittlement, deteriorated ink)? If so, to what degree?

3. Is there evidence of photochemical damage (e.g. fading, discoloration, embrittlement)? What?

4. Is there damage to bindings (e.g. detached boards, loose or broken hinges, damaged stitching or other attachment structure, deteriorated adhesive)? What?

5. Do coverings show damage (e.g. red rot, split hinges, detached spine, abraded edges or corners, missing pieces, tears)? What?

6. Is there evidence of mold, rodent, or insect damage? What?

7. Is there evidence of poor handling or vandalism (e.g. torn endcaps, torn or missing pages, graffiti, folds)? What?

8. Is there other damage?

9. Are there objects or areas of the collections that will be severely damaged by further handling?

Should these be removed from public use, or reformatted for research use?

C. Storage and Handling Practices: Books

With experience, preservation professionals have identified the storage furniture and enclosures, handling procedures, and supports that provide the best protection for each category of collections (e.g. books, pamphlets, maps, photographs, documents, art on paper). Many of these are outlined below, and any surveyor unfamiliar with the basic principles for protective storage of materials common to library and archives collections should read these sections carefully, and apply these principles in evaluating the condition of collections.

Shelving Procedures:

Books should not be allowed to lean to the side, since this causes unnecessary strain on covers and joints. They should be shelved upright, standing on their tails, supported by each other and by bookends. Books that are too tall for their shelf are best shelved horizontally. If this is not practical, they should be shelved spine down. Books should never be shelved with the spine up, since the weight of the pages will eventually pull the text block out of the cover. A buffered flag can be used to make label information readily visible.

The non-knifing variety of bookend, which has a lip, is preferred to the knifing variety, which allows books to be jammed onto its sharp edge. A brick can be covered with bookcloth fastened with PVA adhesive and used as a good book support. Another alternative is a piece of acid-free foam-core covered with bookcloth and slipped over the upright of a knifing bookend to shield the metal edge.

Heavy, oversized volumes should be stored flat, not vertically, to give them the overall support they require. They should be stacked no more than two or three high to facilitate safe handling. This may require the insertion of additional shelves at narrow intervals. Shelves must be wide enough to support oversized volumes completely, and books must not be allowed to protrude into aisles, where they are subject to bumps and abrasion.

Books of enduring value should be shelved by size. Very small volumes do not provide the support that much larger bindings need, and can be crushed by the weight of larger books.

Handling Procedures:

Books should not be pulled off the shelves by the headcap, a practice that causes the headcap to fail, tearing the spine. Instead the books on either side of the desired book should be pushed in and the desired book pulled out gently with a finger on either side of the spine. Books should not be stacked too high when they are moved or carried, to minimize chances of dropping them.

Housekeeping:

There should be a general cleaning of books and archival storage boxes at least once a year in order to prevent soiling and abrasion of paper. Feather dusters should not be used since they only rearrange dust. Instead, heavy dust and dirt should be carefully vacuumed. If the dust is not heavy, One-Wipe or Stretch-N-Dust chemically-treated dust cloths may be used safely. A separate cloth should be used to clean the shelves. These cloths are available in local markets. Alternatively, a soft dust cloth sprayed with EnDust and allowed to dry overnight may be used.

Since cleaning has the potential to damage books, volunteers or other personnel with this responsibility must be taught careful handling techniques. If a collection has valuable, damaged, or fragile bindings, these should be cleaned only as necessary, at the discretion of the librarian or curator. Heavy accumulations of dust should not be allowed to build up.

All acidic inserts (bookmarks, scraps of paper, pressed flowers, etc.) should be carefully removed from books so that the acid they contain is not transferred to the book pages with resultant staining.

Labels:

Adhesive labels, pockets, bookplates, and bar codes are all common in libraries and archives. Pressure-sensitive adhesives should never be applied to materials of enduring value. Backings deteriorate and fall off, leaving a sticky residue; all tested adhesives have shown themselves to be unstable over time. Some can be removed with powerful solvents, but in the worst case the adhesive will permeate paper or binding material, and become completely unremovable.

Call numbers should not be painted on books that have value as artifacts, nor should they be typed on labels taped to these volumes with pressure sensitive tape. Paint is disfiguring; tape will discolor and stain the binding. Instead, call numbers should be typed onto flags made of alkaline card stock and placed inside the volume. These flags should be about 2" wide, and 2-3" longer than the book is high.

Unfortunately there is no satisfactory solution to the problem of call numbers and other labels on books of undetermined artifact value— and books with long-term research value fall into this group. One strategy is to use a polyester book jacket fastened with 3M double-sided tape no. 415, and to label the jacket.

If bookplates or pockets are used in books of enduring value, they should be made of low-lignin, alkaline paper, and attached with a stable, reversible adhesive, preferably wheat starch paste or methyl cellulose.

The Library of Congress has developed a set of specifications for commercial bar-code labels. They recommend that the label itself be made of either (a) white pigmented polyester or (b) white litho-destructive paper covered with a film of polyester or polypropylene. The polyester may be used with an acrylic or silicone adhesive; polypropylene may only be used with the silicon adhesive. The acrylic adhesive may be pressure or heat activated. We recommend the heat-activated acrylic adhesive as being most likely to be stable and least likely to be wholly irreversible after aging. The Preservation Program Office of the Library of Congress, Washington, D.C. 20540 (202-287-1840) may be contacted for detailed information.

Bar codes should never be applied to special collections materials, since the volume will almost invariably be damaged. If computerized codes must be used for rare or special volumes, the label can be attached to a flag of alkaline paper placed in the book.

With all of these principles in mind:

1. Are staff members and users taught appropriate handling practices?
2. Are book supports (bookends) systematically used, and are books held upright on shelves?
3. Are all books shelved upright, horizontally, or spine down?
4. Are books of special value shelved by size? If the collection contains oversized books, are they shelved horizontally in stacks of no more than 2 or 3 volumes? Do any books extend beyond the shelf that holds them?
5. Is there a program of custom-fit (phase) boxes for damaged books?
6. Do books contain newsclippings, place markers, or other potentially damaging inserts?
7. Are damaged bindings being held together by rubber bands or other potentially damaging

techniques?

8. What bookplates, pockets, labels, identifying marks, or circulation controls are in use? For which categories of the book collection? Are the labels (etc.) stable?

9. Is there a book drop for after-hours returns? Is it designed to protect books from a drop of more than 6"? Is it padded?

D. Storage and Handling Practices: Non-Book Formats

An excellent guide to storage and handling for archival collections has been written by Mary Lynn Ritzenthaler (Chapter 6 in Archives and Manuscripts: Conservation, Basic Manual Series, Chicago, IL: Society of American Archivists, 1983). A condensation is included with permission in the resource materials in this publication. When evaluating these collections, remember that acid migrates from inferior-quality paper to any other papers with which it comes in direct contact. It is very important to separate poor-quality papers from those that have a high rag content. Newsclippings and other obviously inferior-quality papers must be removed from direct contact with historical documents and manuscripts. Informational newsclippings can be photocopied onto permanent, durable paper.

Those responsible for archival collections should use low-lignin, buffered file folders, boxes, and other storage materials for most collections of permanent value (exceptions are noted below). These housings are available from most conservation suppliers. Please see "Archival-quality Storage Enclosures" in the resource section for additional detail. In this guide, "archival-quality" means meeting the specifications for protective storage detailed here and in the reprints attached.

Librarians and curators should be careful to store objects of the same size and category together. Differences in bulk and weight create a potential for physical damage, so it is not advisable to store single sheets in the same box with books or pamphlets. Generally speaking, heavy objects should be stored separately from lighter objects, as should bulky objects (which cause uneven pressures inside boxes).

1. Documents and manuscripts

These should be unfolded for storage; all foreign objects like staples, paper clips, and pins should be carefully removed. All fasteners produce some unnecessary damage. Documents should be stored in low-lignin, buffered file folders; no more than approximately fifteen sheets should be placed in each folder. The folders should then be placed in archival-quality document storage boxes as close to the size of the folders as possible. All folders in each box should be the same size. Boxes should be full enough to prevent slumping of the contents. Partially full boxes can be filled with crumpled buffered tissue or lignin-free corrugated board cut to the size of the folders (e.g. "Lig-Free," available from Conservation Materials International). Do not stuff boxes--this can cause damage when sheets are removed, refiled or reviewed.

An alternative to boxed storage is a standard baked enamel file cabinet equipped with hanging racks and hanging folders. Hanging folders are not yet available in archival-quality materials, but the conventional "Pendaflex" type folders are acceptable as long as the enclosures (folders, etc.) within them are buffered.

Parchment and vellum are highly susceptible to damage from fluctuations in relative humidity. They require stringent humidity controls. Such documents should be enclosed for additional protection. Suitable enclosures include encapsulation, folders, matting and framing, and boxing, or a combination of these techniques.

a. Are documents stored in limited quantities in archival-quality folders and in hanging files or archival-quality boxes?

b. Have all fasteners and insertions been removed from manuscript collections?

c. Are folded documents filed or boxed? Can they be unfolded without damage?

d. If the collection contains parchment or vellum documents (or bindings), have they been provided with adequate protection from humidity changes?

e. Does the institution have rules governing the use of research materials (e.g. only pencils may be used, no food and drink in the research rooms), and are these stated for every user? Are they enforced?

2. Photographs

Prints and negatives are best stored in individual enclosures. This reduces damage to the photograph by giving it physical support and protection. Acceptable enclosures can be made of either paper or plastic. Paper enclosures are opaque, making it necessary to remove the object from the enclosure for examination; plastic enclosures have the advantage of allowing a researcher to view the image without handling it, reducing the possibility of scratching or abrasion.

Plastic materials suitable for photographic storage are polyester (e.g. Mylar, Melinex), polypropylene, and polyethylene. Plastic enclosures can be either envelopes or two-sided sleeves. Some sleeves are held together with a fold-over lip, and can be opened. If acceptable plastic enclosures come with lining paper, this paper should always be discarded. It is usually poor in quality and prone to deterioration.

Photographs should generally be enclosed in low-lignin neutral paper rather than alkaline paper, since some emulsions react with buffering materials. If envelopes with adhesive joins are used, the adhesive must be stable and pH neutral, and the emulsion should face away from the joins. Nitrate and early safety negatives should always be stored in buffered enclosures (not plastic).

Once they have been individually enclosed in paper or plastic, photographs are best stored flat in drop front boxes of archival quality. The boxes should be housed on shelves or in metal cabinets. All enclosures within a box should be the same size, fitting the size of the box. Neutral file folders may be used to help organize photographs within the box.

Horizontal storage is preferable, since it provides over-all support and prevents mechanical damage from bending or slumping, but vertical storage can be successfully used. For vertical storage, protected photographs should be placed in neutral folders that are themselves placed in hanging file folders. Several photographs may be stored in each folder and several folders may be placed in each hanging file. The use of lightly filled hanging file folders will prevent photographs from sliding down under each other in the drawer and will facilitate their handling.

Special care must be given to the storage of oversized photographic prints mounted on cardboard. This cardboard is often acidic, causing the mounts to become brittle with age. Embrittlement of the support can endanger the image itself, if the cardboard breaks in storage or during handling. Such prints must be very carefully stored; they should be placed in individual folders in archival quality boxes of appropriate size, labeled to lie flat on shelves. They should be handled with great care.

a. Are prints and negatives individually enclosed, and filed or boxed in archival-quality enclosures?

b. Are photographs in different formats and sizes (e.g. glass plate negatives, stereo views, mounted prints, cased photographs) grouped and stored by size and format?

c. Are there any nitrate or early safety film negatives in your collection? Is there any evidence of deterioration (bubbling of emulsion, discoloration, odor)? Have arrangements been made to duplicate and discard nitrate film? Early safety film? Are these negatives stored in buffered enclosures and isolated from the rest of the collections?

d. Have photocopies or duplicate prints been made for first access to photograph collections, so originals need not be handled?

e. Are original prints and negatives handled only when absolutely necessary, and are gloves used to handle them?

f. Are photographs protected from light and climate extremes?

3. Pamphlets

Pamphlets and small booklets, like single sheets, can be stored in archival-quality boxes or in hanging folders. Pamphlets of the same cover size can be stored in drop-spine or phase boxes.

Pamphlets that differ in size may be stored according to guidelines given for manuscripts and documents (above). Pamphlets more than about 1/4" thick should be stored spine down in individual folders. Pamphlets of very different size should not be stored in the same folder.

If individual pamphlets must be shelved between books, they must be individually boxed. Groups of pamphlets shelved between books can be boxed together if the guidelines above are followed.

If pamphlet binders are used, they must be of archival quality throughout. They should never be glued directly to pamphlets. Where stitching is used to join pamphlet and binder, it should be done through the fold or in original fastener holes where possible.

a. Are pamphlets enclosed in archival-quality binders or enclosures? Are pamphlets stored in boxes?

b. Are pamphlets bound in the past being damaged by binding materials (adhesives, covers)?

4. Oversized materials

Prints, maps, broadsides, and other oversized objects are best stored flat in the drawers of map file cabinets or in large covered boxes of archival quality (available from conservation suppliers). The objects should be placed in folders cut to fit the size of the drawer or box; full-sized folders are preferable to small folders, which tend to shift position as the drawers open and close, and get jammed at the back of the drawers.

Blueprints and other colored objects should not be stored in alkaline folders because some pigments may react and change color. Lignin-free, neutral folders should be used for these materials. See the attachment "Archival-quality Storage Enclosures" for additional details.

Several objects may be placed in a folder. Interleaving with neutral tissue paper is desirable, especially if the object has special value or is hand-colored.

Aisles and work surfaces where oversized materials are used must be large enough to allow them to be handled without damage.

If oversized objects must be rolled, make sure the paper is not too brittle to withstand unrolling. A tube longer than the rolled object, and at least 4" in diameter must be used (and larger diameters are preferred). If the tube itself is not low-lignin and pH neutral, it must be wrapped in neutral or buffered paper. The object is then rolled onto the tube, and the assembly is wrapped with neutral or buffered paper to protect it from abrasion. This assembly can then be stored inside a larger tube for added protection. Tubes should be stored horizontally.

Any prints, drawings or other objects that have been matted or backed with acidic materials or wood should be removed from those mounts. They should be reframed in their original frames using museum-quality materials and techniques. Alternatively, they may be stored unframed in folders inside boxes or drawers, as described above.

a. Does the collection contain maps, broadsides, architectural drawings or other oversized objects?

b. Are these objects stored flat? Are map cases or other large scale storage units available to provide necessary protection and support?

c. Are archival-quality folders, tissue, and other materials in use for these objects? Are protective enclosures cut to the dimensions of their contents?

d. Do aisles and work surfaces provide enough room to protect oversized objects from abraded edges and accidental folding?

e. If oversized objects must be rolled, are large-diameter tubes used?

f. Are tubes neutral or covered with neutral or buffered paper, and are objects rolled around the outside of the tube? Is the assembly wrapped with neutral or buffered paper?

5. Newsprint

Because groundwood papers were commercially produced after about 1840, newsprint produced after that date may be highly acidic. Long-term preservation of this paper is difficult at best. It is possible to treat newsprint by deacidification to retard its deterioration, but this treatment is usually economically impractical. It should also be noted that deacidification after paper has become yellow and brittle will not make the paper white and flexible again. Microfilming is usually the preservation option of choice for newspaper collections.

Most newsclippings are important because of the information they contain and not because of the value of the clippings themselves. For this reason, photocopying or microfilming are considered the most practical preservation options for collections of newsclippings. All photocopying should be done on archival quality paper; originals can then be deaccessioned at the discretion of the librarian or curator. Newsclippings with photographs that do not photocopy well may be physically separated from other papers in a folder by placing them inside an enclosure made of polyester. Newsclippings that are to be retained in their original form should be deacidified, and must be stored in buffered enclosures.

a. Are newsclippings separated from higher-quality paper?

b. Are newsclippings photocopied onto permanent paper or otherwise reproduced for preservation purposes?

c. If original newsclippings are retained, are they stored according to the principles for documents, and in buffered enclosures?

6. Scrapbooks and Ephemera

Many historical collections include scrapbooks and ephemera (e.g., tradecards, valentines, patterns, paperdolls, etc.). These objects pose challenging preservation problems, because they often contain a variety of components and media. They may have raised surfaces or three-dimensional decoration. They are frequently unique, fragile, damaged, or of significant associational value. They should never be interfiled with other categories of library and archives material, because significant chemical and mechanical damage can result from the different sizes, shapes, weights, adhesives, and media represented.

Most scrapbooks and ephemera can be handled according to general guidelines for other, parallel categories of artifact. Objects that have informational value alone (for instance, some clippings scrapbooks) can be photocopied onto archival-quality paper and boxed, bound, or enfoldered. The originals can be retired from use, and copies made available to researchers. Scrapbooks that have enduring value in their original form should be individually boxed in custom-fitted boxes. Valuable scrapbooks may have a high priority for evaluation by a conservator. A good guide to the care of scrapbooks is Barbara Zucker's "Scrapbooks and Albums: Their Care and Conservation," (Illinois State Library, Preservation Office, Room 288, Centennial Building, Springfield, IL 62756; see resource materials).

Other artifacts should be grouped by size and composition (e.g., photographs, printed material, documents, etc.), enclosed to protect them from chemical migration and mechanical damage, and stored in a way that will support the structure of the artifact (encapsulated, boxed, stored flat or in hanging files, etc.). Some vendors of archival supplies offer custom sized storage boxes and sleeves for common ephemera such as postcards and stereo views. Others can produce custom-sized boxes in quantity to meet special needs.

Given these considerations, perhaps the most important questions for including these materials in a preservation program will be:

a. Does the collection contain a significant quantity of these formats? Are they of informational value alone? Are they of artifact value?

b. Are scrapbooks individually boxed and stored flat? Are original artifacts accessible to patrons? Are copies available?

c. Are ephemera filed or boxed according to intellectual value, and interfiled with other categories of material, or are their preservation needs being met? Are these objects of sufficient value to warrant reorganization by size, category, etc.?

7. Non-Traditional Formats

Library and archives collections frequently include recorded sound media, videos, 35-mm color slides, computer records, and other non traditional materials. Unfortunately, none of these is considered to be "archival"—that is, capable of surviving with minimal deterioration for long periods of time. These media are susceptible to damage from many of the same agents that cause deterioration in books and paper. Like the more traditional formats, their physical condition will benefit from well controlled environments, careful handling, and protective storage.

These materials are outside the scope of this manual, but several sources are recommended to surveyors faced with significant collections in non-traditional formats with enduring value. Susan Swartzburg's Conservation in the Library: A Handbook on the Use and Care of Traditional and Nontraditional Materials (Westport, CT: Greenwood Press, 1983) is a good starting place. The Library of Congress Motion Picture, Broadcasting, and Recorded Sound Division (Washington, D.C. 20540) can provide assistance in identifying literature, consultants, and procedures for caring for those media.

VI. REFORMATTING

When materials have informational value only, or when their value and condition makes it necessary to limit handling, there are a number of preservation reformatting strategies available. When original photographs, unique or valuable materials, or fragile materials are part of the collection, a copy can be provided for research use, or at least for initial access and review. Photocopying, facsimiles, and microfilm are addressed here. Staff should be familiar with national standards and the options that apply to these processes.

A. Preservation Photocopying

Books and archival materials are often unnecessarily damaged during photocopying. Photocopy machines with flat copy platens necessitate jamming the binding flat in order to get a good image. Machines with edge platens allow a book page to be copied with the book open only to 90 degrees instead of 180 degrees. Xerox (Xerox Square, Rochester, NY 14644), Dual Office Suppliers (2411 Bond Street, University Park, IL 40466), and Oce-Business Systems, Inc. (1351 Washington Boulevard, Stamford, CT 06904) have recently marketed copiers suitable for copying books safely, but careful handling must usually be substituted for a well-designed machine.

Historical materials and volumes with permanent research value should only be photocopied by staff members (not by researchers), and then only if it can be done without causing damage to the objects themselves. Never press down on the spine of a book with your hand or the cover of the copier to insure a good quality image.

Photocopying onto permanent, durable paper using an electrostatic copier is an option that can be used in-house if an item can be copied without damage, or if the original format has no value. Permanent/durable ("archival-quality") paper is defined by ANSI Standard Z39.48-1984. A number of facilities specialize in facsimile reproduction of brittle books by photocopying them onto permanent paper and binding them.

1. Does the library use photocopying as a preservation tool? As a patron service?

2. Who is allowed to photocopy? What may be photocopied? What may not be photocopied? How are these materials identified?

3. Is preservation copying done with an electrostatic copier on permanent paper?

4. What is included in the preservation photocopying program? What should be included for reasons of value or vulnerability to damage?

B. Microforms

Microfilm is an important preservation strategy for material that has information value rather than artifact value, or for material that has such great artifact value that it should not be routinely handled by researchers. It is effective for preservation only if some basic principles are followed. These include filming and processing that meet formal preservation standards, excellent storage for master microfilms, equipment that is well maintained, and the use of microfilm or microfiche copies (rather than original film) by researchers. If your collection contains microfilm produced for preservation purposes, and if you are not knowledgeable about preservation microfilming, see the attachment titled "Microfilm and Microfiche."

1. If microfilm is produced in-house, does it meet published standards for filming, processing, and storage?

2. If a commercial vendor provides microfilming, does your contract specify preservation standards for filming, processing, and storage?

3. Is film inspected to make sure it meets quality standards? What inspection methods are used?

4. Are archival practices and enclosures used for microform storage?

5. Are master microfilms stored at a site separate from use copies? Does this site meet environmental standards for microfilm preservation?

6. Are microform readers cleaned and maintained on a regular basis? By whom, and how often?

7. Are staff and users instructed in the use of microform equipment? Are users well supervised?

8. Are there breaks, scratches, spots, or other damage in the microform collection?

VII. LIBRARY BINDING

Formal standards have been adopted for library binding, and are available in the 8th edition of The Library Binding Institute Standard for Library Binding (1986, Paul Parisi and Jan Merrill-Oldham, The Library Binding Institute, 8013 Centre Park Drive, Austin, Texas 78754).

In recent years numerous discussions of considerations for the binding of research materials have appeared in the library literature. Any library that uses commercial library binding for preservation purposes should be familiar with the options that have replaced oversewing/"Class A" binding, and should make decisions for its own collections based on those options. Contracts with library binders should specify standards, procedures, and guidelines covering the range of materials in a library's binding program. Books returned by the binder should be individually inspected for quality of work and adherence to these specifications.

Volumes with value as artifacts should never be rebound using library binding techniques or materials.

The questions below are based on inspection guidelines developed by Jan Merrill-Oldham for the University of Connecticut at Storrs. Examining a sample of volumes that have been rebound by your library binder should show whether the best available procedures have been and are being used for your collections. The most important questions are: (a) Is avoidable damage being done to rebound volumes? (b) Do rebound books open easily and stay open in use? (c) Do the bindings withstand normal use?

1. Bindings and Covers

   a. Is the spine shaped properly at head and tail (top and bottom)? Are the joints (outside hinges) parallel to the spine and deep enough to allow the book to open easily?

   b. Is the covering material free of grime and glue? Is it completely adhered to the cover boards? Are turn-ins (inside corner folds of covering cloth) flat and smooth?

   c. Does the spine lining come to within 1/2" of the head and tail? Is it completely adhered to the spine of the textblock?

   d. Do the boards extend evenly and an appropriate distance beyond the textblock at head, tail, and fore edge?

2. Attachment and Binding Structure

   a. Are endpapers smoothly and completely attached to the boards? Are they clean, evenly trimmed, and evenly positioned? Is there adhesive extruded from beneath the papers?

b. Does the lining material extend at least 1" onto the board beneath the endpaper? Is it uniform on each board?

c. Has the textblock been trimmed? Was this acceptable to the institution? Are all sheets and illustrations squared and complete?

e. Does the book still have an inner margin?

f. Are all leaves (pages) securely attached? Are they in the correct order? Is there adhesive on the edges or in the margins? Does this prevent the book from opening?

VIII. CONSERVATION PRACTICES

Treatment of individual volumes should be determined by their value to the collections and the availability of funds for conservation. Setting priorities should be the first step in treatment: criteria to be considered include condition; monetary, historical, or artifactual value; importance for research; and expected use. Volumes can be treated at a professional conservation facility or in-house, depending on their importance and the treatment required. It is more important to treat books that are in fragile condition and must be handled by researchers than it is to treat books that are never handled.

Some conservation techniques can be applied "in-house"; other repairs and restoration must be done by professional conservators. Techniques used without the supervision of a conservator should be limited to objects that do not have enduring value to the collections.

"Safe" in-house techniques include rehousing objects in archivally appropriate enclosures; simple cleaning of books and some other paper materials with archivally sound procedures and materials; simple repairs of book pages or documents in research use; and polyester film encapsulation of documentary materials. All else, including deacidification, should be done by professional conservators, bookbinders, or technicians working under the supervision of an experienced professional.

Paper that has artifactual or permanent research value should only be mended using conservation-approved methods and materials. Pressure-sensitive tapes and many other adhesives have proven unstable over the long term, and many will cause permanent damage. The only acceptable methods for repair of valuable papers have been included as an attachment.

Simple repairs and cleaning of bindings with no special value may be done in-house. Conservation Treatment Procedures and Robert J. Milevski's Book Repair Manual (Illinois Cooperative Conservation Program, Illinois State Library, Springfield, IL 62756) both contain very useful information for planning and structuring an in-house book care program.

Conservators once recommended using potassium lactate and leather dressing for the care of leather bindings. Unfortunately, these treatments were often applied with a heavy hand, and unforeseen chemical reactions and damage have resulted. Most conservators now feel that librarians should not treat leather bindings (other than to wipe them with a soft cloth and to box them) because our knowledge of binding leathers and leather dressings is inadequate. Jane Greenfield (The Care of Fine Books, New York: Nick Lyons Books, 1988) considers this treatment issue thoughtfully.

If your institution has a repair technician (rather than a conservator), this person must be well trained in repair techniques, and must have the experience and judgment required to make sound decisions. Basic repairs such as hinge tightening, recasing, endpaper replacement, and rebacking are often inappropriate for books in historical collections. Sometimes the best treatment for artifacts is no treatment (other than boxing). It is critical that staff members know their limits, know when to ask for a conservator's assistance, and have good supervision.

Books with damaged bindings should never be held together with rubberbands, which contain sulfur and will deteriorate to cause further damage. If detached covers must be tied onto books as a temporary protection, ties should be undyed flat cotton or linen tape, or undyed polyester ribbon, and any knots should be at the top or fore edge of the textblock to prevent damage from pressure against other books.

Boxing should be employed in any institution with books of artifact value. Boxes constructed of conservationally-safe materials can be custom made to fit a book's measurements. They provide support for the volume and protection from dirt, dust, light, and mechanical damage. Volumes with artifactual value, where the fragile binding is to be retained in its present condition, should be boxed. Volumes that have low value or are rarely used and do not warrant treatment for repair of the binding may also be boxed.

Usually it is more economical to purchase commercially made boxes than to buy the equipment and materials necessary to produce good boxes in-house. We do not recommend prefabricated box "board" because it cannot provide a close fit for many books, and because the board is too thin to provide adequate support. For a large-scale boxing program, see procedures and equipment detailed in Conservation Treatment Procedures (Morrow and Dyal).

Phase boxes are now available commercially at very reasonable cost. More permanent custom-made boxes can be made for books of special value by professional conservators. Such boxes should be clam-shell (also called drop-spine) boxes, rather than slip cases, which tend to cause mechanical damage to books. They are available from Northeast Document Conservation Center, among other sources.

A. Repair Program Management

1. Is there anyone who can recognize and identify acid deterioration, photochemical damage, water damage or damage caused by high humidity or condensation, the effects of fluctuations in heat and humidity on paper, insect damage, rodent damage, mold damage in its early stages as well as advanced fungus growth?

2. Is there an established procedure for periodic examination of all collections?

3. Is there someone on the staff with the responsibility of deciding what can be carried out in-house and what must be sent to a conservator for treatment?

4. How are items in need of preservation action identified? Are research, technical services, and circulation staff trained to automatically examine returned materials for damage?

5. Are there provisions to bring reports of damage to the attention of a trained staff member? Is that person qualified to determine whether the material should be replaced, repaired, duplicated for research use (i.e. by photocopying or microfilming), treated by a conservator, or discarded?

6. If an object requires conservation treatment, who is qualified to authorize the treatment?

7. How are supplies and materials chosen? What insures their quality and appropriateness?

8. Are other preservation activities (e.g. microfilming, library binding, photocopying) coordinated with this department?

B. In-House Conservation Practices

1. Does the institution have written guidelines covering decisions for conservation procedures? For the procedures themselves?

2. How is the in-house repair program staffed? How is it supervised? How are the personnel trained?

3. What is staff required to do? What is staff trained not to attempt?

4. What workshop space, tools, and equipment are available?

5. What is the "production requirement"? What is the cost per repair?

6. Does the repair program routinely treat leather bindings with potassium lactate or leather dressing?

IX. EXHIBITION OF LIBRARY AND ARCHIVAL MATERIALS

The need to exhibit documentary artifacts and books complicates the goal of preservation. The display environment is often more difficult to control than the storage environment; the materials displayed have, almost by definition, special value; and preservation is often secondary to an exhibit designer. At the very least, exhibited objects are exposed to higher light levels than they would normally experience in storage.

We recommend that light levels in exhibit spaces be limited to 50 lux. It is easier for visitors to adapt to low light levels if the light is diffused (rather than direct), if light levels in surrounding rooms are reduced, and if an explanation for the controlled light is offered. There should never be direct sunlight from windows or skylights in exhibit spaces; all windows should be provided with ultraviolet filters and shades. Finally, we strongly recommend that no original artifact be exhibited for more than 2 or 3 months. Exhibits or objects in them should be rotated regularly to prevent damage.

Duplicate photographs can usually be made, and extremely good facsimiles can now be produced at a reasonable cost. Canon is marketing a computer-modulated four-color (plus black) photocopier that makes exceptional reproductions on alkaline paper. Other manufacturers have also entered this field. Such copiers are prohibitively expensive for most institutions, but the service is increasingly available commercially. We recommend exhibiting duplicates or facsimiles whenever possible, or perhaps alternating original and facsimile objects in long-term exhibits.

Exhibit cases should be built of stable, pollutant-free materials and coatings; mounts, supports, and other exhibit materials should be made from inert materials like plexiglas and polyester, or from neutral paper. Exhibit cases should not contain lights, since these create significant changes in temperature and relative humidity.

Documents should be completely supported by mats and museum-quality framing and hinging techniques, or by polyester slings, bands, or coversheets. Good instructions for matting, hinging, and framing are given in Ann Clapp's Curatorial Care of Works of Art on Paper (New York: Nick Lyons, 1987), and Margaret Holben Ellis's The Care of Prints and Drawings (Nashville: American Association for State and Local History, 1987). Additional suggestions are available in Gail Casterline's Archives and Manuscripts: Exhibits (Basic Manual Series, Chicago: Society of American Archivists, 1980).

Books must be well supported to protect their bindings from strain. Supports can be made from neutral mat board or plexiglas. A stand or mount should support the entire cover(s) of a book as well as the spine. Reasonably good plexiglas supports are currently available from University Products (Holyoke, MA 01041). Most books, and all oversized books, should be exhibited at no more than a gentle angle. If the book will not remain open naturally, a polyester band closed with 3M double-sided tape no. 415 can be used to hold the book open. Books can be structurally damaged by long-term exhibition in an open position; exhibit periods must be limited.

1. Does the institution exhibit books, documents, or other artifacts?

2. Are cases constructed of conservationally stable materials and coatings? Do they have interior lighting? Is this turned off?

3. Does the institution have written guidelines for what may or may not be exhibited? For how exhibits should be prepared?

4. Who has responsibility for designing and building exhibits? Is this person knowledgeable about the preservation requirements?

5. Are any artifacts in the collection permanently displayed?

6. Are all exhibits fully and safely supported with stable materials?

7. What are the light levels in exhibit spaces? Are any exhibit areas lit by windows or other natural light? Are shades and ultraviolet filters used?

8. Are facsimiles or duplicates used where possible? Are exhibits changed or objects rotated every few months?

9. Are any artifacts in the collections matted or framed in acidic materials? Are any frames backed with wood?

10. What security precautions are taken for exhibited objects?

X. PRESERVATION MANAGEMENT

An effective preservation program needs a budget and effective coordination. Someone on the staff must have assigned responsibility for being knowledgeable about preservation issues, and for making preservation decisions. Such decisions will concern priority-setting, the choice of storage furniture, materials, and procedures, contract specifications with outside vendors, climate monitoring, and environmental standards inside the institution. The support of senior management staff is essential for the operation of an effective preservation program. With these concerns in mind, the following concerns are important to a comprehensive preservation survey.

1. Are the institution's senior administrator and trustees aware of preservation needs and committed to the protection of the collections?

2. Is preservation viewed by the institution as a concern applicable to all collections, or one that is limited to rare books and special materials?

3. Is there a line item for preservation in the institution's budget? What amount is spent per year on library binding? Preservation microfilming? In-house repairs? Archival enclosures (e.g. phase boxing, folders, boxes)? Conservation treatments? Other (what)?

4. Is there a program of preservation education for trustees? Staff (at what levels)? Public? What do these programs consist of?

5. Does the institution have a long-range goal for preservation? Is this a written document? What does it include?

6. Has a staff member been assigned formal responsibility for preservation activities? To whom does the preservation officer report? (In some institutions, a committee is more effective in managing preservation activities. If an institution uses a committee for this function, each of

the responsibilities and knowledge reflected by the questions below should be held by at least one committee member.)

a. Does this person have authority to monitor facility environment, storage practices, and security?

b. Does this person recognize common forms of damage to library and archival materials and their causes?

c. Does this person decide which material can be treated in-house, and what needs to be sent out?

d. Does this person know what permanent/durable paper/books and archival-quality materials are?

e. Has this person established a procedure to examine the condition of materials in the collection on a regular basis?

f. Does this person coordinate the library binding program? Is this person familiar with the binding options that exist, and able to choose the most appropriate method(s) for each category of material, or each volume?

g. If the institution has a preservation microfilming program, is this person familiar with preparation procedures; national standards for filming, processing, and storage; film options; and cost/use benefits for various formats?

h. Does this person advise on the conservation implications for all exhibits and programs?

i. What responsibility does this person have for disaster planning and emergency response?

j. Does this person conduct preservation awareness or information programs on a regular basis for staff and patrons?

k. Is this person aware of (or involved in) preservation activity on the state, regional, or national level?

l. What opportunities does this person have for maintaining current knowledge of preservation and conservation practices?

7. Does institutional policy indicate which materials are valuable as objects, and which are valuable only for their information content?

8. Does the acquisition and collection-development policy provide guidelines for determining the format of new acquisitions, or repair/replacement/restoration decisions based on:

a. The relationship of the item to the entire collection?

b. The research, historical, or artifactual importance of the item?

c. The projected frequency of use?

d. The permanent or temporary value of the item?

e. The permanence or durability of the media?

9. Is there a procedure for periodic weeding of the collection to eliminate those materials no longer required by the institution or its patrons? Is poor physical condition one of the criteria for discard?

10. Is the facility's space being optimally used for storage of its collections? What could be relocated to expand space for collections? Has the institution considered changes in storage to improve the condition of collections (e.g. transfer of documents from files to boxes/shelving, installation of compact shelving, use of off-site storage)?

11. Has the institution considered renovation or expansion for preservation purposes?

12. What is the size of your staff ("FTE" = full-time equivalent)?

__ FTE professionals __ FTE support/technical staff
__ Student assistants, representing __ FTE
__ Volunteers, representing __ FTE

13. Are staff numbers and training adequate to carry out the basic preservation activities needed by this institution?

14. Has the organization considered adding staff to facilitate preservation activities? Has it considered re-structuring position descriptions to facilitate preservation activities?

CONCLUSION

The preceding provides a guide for evaluating the ability of a library, archives, or other repository building to protect its collections, the general condition of its paper-based or documentary materials, and the institution's preservation program needs. When this information is complete, trouble spots should be obvious, and necessary remedial action will probably be apparent. If it is not, ask a professional conservator for help in finding strategies to eliminate or minimize the effects of unstable temperatures and humidity, destructive lighting conditions, unsatisfactory building maintenance and housekeeping, or other problems.

The deterioration of our books and documents has been inherent in our hunger for information, and in the industrial and technological developments this hunger produced. We have been forced to recognize that the records of culture and information are not a self-renewing resource. Fortunately, we have also learned that their loss can be delayed for the foreseeable future if we apply the knowledge we have gained about the nature of our most familiar medium.

Preservation management is not easy or cheap, but if we neglect the responsibility for systematic planning, many of our collections will be damaged beyond salvage in our own lifetimes. Much of our nation's wealth will be needlessly lost.

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FORM B

CONDITIONS IN STORAGE AND EXHIBIT SPACES

This form can be used to record data needed for evaluation of the rooms in a building from the viewpoint of preservation impact; make a separate sheet for each room surveyed.

Institution: Date: By:

Location: Room: Floor:

Length ___ ft Width ___ ft Height ___ ft

Temperature ___ °F Relative Humidity ___ %

Pollutants _____ Housekeeping _____

Room Contents:

Stored in:

Light
Natural:
Artificial:
UV control:

HVAC Equipment
Heat arrangement:
Cooling:
Humidity control:

General Security (theft and vandalism):

Fire Hazards
Electrical:
Heating:
Other:

Water Risks
Plumbing:
Steam pipes:
Building leaks:

Evidence of
Humidity extremes:
Temperature extremes:
Leaks:
Insects:
Mold:
Light damage:

Comments:

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FORM C1

CONDITION OF COLLECTIONS

Institution: Date: By:

Name of Collection:

Type of Material:

Stored in Room: Floor:

Manner of Storage:

Condition of Collection:

a. Appearance:

Wear and tear:

Soil and surface dirt:

Water stains:

b. Acid Damage:

Discoloration:

Embrittlement:

pH:

c. Mold Damage:

Obvious growth:

Staining:

Pulping:

d. Insect Damage:

e. Photochemical Damage:

Fading:

Other:

f. Other Damage:

Remarks:

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FORM A

GENERAL BUILDING OBSERVATIONS

This form may be used to record data needed to evaluate the building from the viewpoint of conservation.

Institution: Date: By:

Architecture
Type of building:

Predominant construction materials:

Site considerations (e.g. elevation, water sources, weather patterns):

Climate Control (HVAC)
Heating System:

Cooling system:

Humidity control system:

Air circulation/filtration systems:

Building Security
Intrusion alarms:
Doors:
Windows:
Key Control:

Fire Security Date of last inspection:
Fire alarms:
Heat sensors:
Sprinklers (type):
Smoke sensors:
Portable extinguishers:
Halon:

Insurance Coverage:

Disaster Plan: Updated within last year?

Staff:
Number:
Preservation Officer:
Experience in conservation:
Treatment facility:

Budget:
Total/yr for library/archives:
Total/yr for preservation:
Preservation/conservation activities included:

Remarks:

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FORM C2

SURVEY RECORD/PAPER COLLECTION

Surveyor: Date: CONSERVATION PRIORITY: 1 2 3

Location (shelf/drawer/section)

Storage Conditions

_____Shelf _____Cabinet _____Map File Other_____
_____Wood _____Metal Other _____
_____Overcrowded _____Poor support _____Need flat storage

Environment
_____Inappropriate temperature _____Inappropriate humidity
_____Excessive light exposure Circle: artificial natural
_____Biological activity Circle: insects rodents mold
_____Excessive pollution/dust exposure Circle: Housekeeping good poor
Other _____

Object Category
_____Book _____Manuscript _____Photograph _____Drawing
_____Oversize book _____Typescript _____Negative _____Architectural drawing
_____Record/ledger _____Printed document _____Tintype _____Blueprint
_____Leatherbound _____Photocopy _____Daguerreotype _____Map
_____Scrapbook _____Bound manuscript _____Album
_____Pamphlet _____Newspaper _____Glass Plate
Other _____

Condition
_____Surface dirt _____Stains _____Tears/abrasion _____Losses
_____Embrittlement _____Unsound binding _____Creases/folds _____Fading
_____Water damage _____Period binding _____Red rot _____Distortion
_____Inclusions _____Fasteners/ties _____Insect/mold damage
Other _____

Status
_____Stable _____Unstable _____Active deterioration

Projected Use
_____Heavy (frequent exhibit, research or education use)
_____Medium (occasional exhibit or research/study use)
_____Low (permanent storage, rare handling)

Recommendations
_____Move collection or modify environment _____No treatment
_____Remove inclusions/fasteners _____Simple cleaning _____Folder/box
_____Phase/book box _____Unframe/reframe _____Store flat
_____Separate materials _____Conservator evaluation needed
Other _____

SEE PRIORITY ASSIGNMENT AT TOP OF PAGE

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TECHNICAL
LEAFLET

Storage and
Handling

CHOOSING ARCHIVAL QUALITY STORAGE ENCLOSURES FOR BOOKS AND PAPER

WHAT DOES "ARCHIVAL QUALITY" MEAN?

"*Archival quality*" is used by preservation specialists to indicate a set of properties that vary for differing materials, but that have in common the effect of reducing the damaging impact of poor environment or handling. True archival-quality enclosures do not produce chemicals that damage the objects they hold, resist deterioration themselves, and provide physical protection and support for their contents. Unfortunately the term archival quality is widely misused. The buyer of preservation supplies must understand the concepts underlying the choice of materials and design for enclosures to obtain enclosures that effectively protect objects of long-term value.

WHAT DAMAGES PAPER?

Good environment and handling practices offer the best protection for valued collections. Where these are imperfect, two other critical factors can produce damage independently, or can interact to multiply damaging effects:

(1) Chemical reactions are responsible for much of the damage we see as embrittlement and discoloration in paper. The best known is *acid hydrolysis*, the production of acids when some chemicals react with the hydrogen in water. *Alkaline* chemicals neutralize acids. Acidity and alkalinity are measured on a scale from *pH* 1.0 (very acidic) through pH 7.0 (neutral) to pH 14.0 (very alkaline, or basic). The pH of paper enclosures is an important preservation consideration.

Unstable storage enclosures can react with their contents, and they themselves can deteriorate to produce acids that damage the materials they house. Highly stable or *inert* materials stay in their original form; they do not give off chemical by-products that damage library and museum objects, and they do not react with the chemical components of paper or other materials to cause deterioration.

(2) Mechanical forces also damage books and paper. Abrasion, tearing, breakage in brittle fibers—all of these are physical or *mechanical* effects. Genuinely protective enclosures prevent or reduce such damage.

BUFFERING

Chemical components of paper and environmental pollutants react with moisture to produce acids. Since brittleness and discoloration in acid-damaged paper cannot be reversed simply by removing the acids and returning the paper to a neutral state, one goal of preservation is to slow their formation through providing a controlled environment. Failing that, they must be removed or neutralized. Paper is often washed to remove harmful chemical residues. This process is called *deacidification*, particularly if chemicals are added during final washing to provide an alkaline reservoir (often called an *alkaline reserve*). The more correct term is *alkalization*. For paper that has water- soluble inks, *nonaqueous deacidification* is necessary. This involves the application of alkaline chemicals in a solvent other than water. Whether this *buffer* is added in manufacturing or conservation treatment, the result is an alkaline (or buffered) paper.

WHAT DOES "ACID-FREE" MEAN?

The term "acid-free" is no longer widely used in the preservation community because it can be misleading. Acid-free enclosures may be neutral (pH 7.0), but this does not indicate that they have the other properties desirable for preservation storage.

The life-expectancy of paper depends on a number of properties besides pH. Fiber length and strength are important to tear resistance, one measure of paper strength. *Lignin* is a natural component of wood that darkens when it is exposed to light. "Lignin-free" (more accurately low-lignin) paper is made from cotton or linen (which contain little lignin) or from other fibers that have had the lignin removed. The presence or absence of lignin and other reactive chemicals affects the resistance of paper to aging. The presence of an alkaline reserve, usually about 2%, reduces the effect of acid formation. In recognition of these important factors, the term *permanent* or *permanent durable* paper is replacing acid-free in professional use. The national standard for permanent (alkaline) paper (ANSI Z39.48-1984) is being revised to recognize these concerns, and will be reissued shortly.

PAPER ENCLOSURES

Low-lignin buffered enclosures (pH 8.5 or above) are desirable for most paper-based objects of enduring value. The best boxes, mats, and folders have these properties throughout. Less expensive enclosures may be constructed with a high-quality covering over a potentially acidic core.

A few paper-based artifacts can be damaged by alkaline chemicals. Works of art on paper (which can contain reactive pigments), blueprints, and some types of photographs should be stored in neutral (unbuffered) low-lignin enclosures if paper enclosures are used.

PLASTIC ENCLOSURES

Plastics (and here the term is used in a very general sense, to refer to the familiar, flexible, often transparent material) vary greatly in stability. Polyethylene and polypropylene can be stable enough for preservation use if they do not contain plasticizers. Plasticizers and vinyls, including polyvinyl chloride (PVC), react readily with many other materials. Triacetate, while it may be chemically stable, can change dimension, so it is not recommended for preservation enclosures. Preservation-grade polyester, better known by brand names (e.g. Melinex 516 or Mylar D), is nearly inert and therefore desirable.

It can be difficult to know if a plastic is suitable for preservation. One simple test for highly unstable plastic is to put a sample in a clean glass jar with a metal lid in the sun for a week. Open the lid and sniff immediately at the opening. If there is an odor, or if a film appears on the interior of the jar, the plastic should not be used for preservation purposes.

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CHEMICALLY ACTIVE ENCLOSURES

A new generation of storage materials based on layers of paper including a buffered core impregnated with activated charcoal has recently become available. Manufacturer's testing suggests that these materials extend the life expectancy of paper significantly further than do simple buffered enclosures. The mechanism would be the capture and reaction of sulfur and other pollutants with activated charcoal and buffering material, which would reduce the pollutants available to react with paper components. The conservation community has not yet had time to evaluate these materials in use, but they look promising (and expensive). Contact Conservation Resources (800-634-6932) for additional information.

DESIGN OF ENCLOSURES

Enclosures have been designed to meet the specific needs of many formats in libraries and archives. Collections managers need to become familiar with the alternatives, but the following generalities apply. (1) Enclosures should provide reinforcement or physical support; they should be stiff enough to protect their contents from tears, breaks, slumping, or other distortion. (2) Boxes should be fully closed (without gaps or handle holes), with snug lids to exclude abrasives and other pollutants. (3) The size and shape of envelopes, boxes, folders, or other enclosures should match the object or objects they hold. An undersized enclosure leads to crushing and distortion of objects. An oversized enclosure can permit interleaving, abrasion, and other mechanical damage. The importance of restricting movement is reflected in the wide size range of enclosures now available from preservation suppliers. (4) Book boxes should be custom made to the dimensions of each book. This will limit binding movement.

FINDING SUPPLIES

Compare catalogs from a variety of suppliers to make sure you find the supplies you want for the best price. Read product descriptions carefully; if you have questions about the composition of a product, ask the supplier for details. If you can't get that information, find another supplier. It's a very good idea to test the supplies you receive before you pay the invoice. Tests can be done using pH pens, pH strips, or a Tri-test Kit (which shows the presence of lignin, and identifies acidic paper). These are available from library and conservation suppliers.

In our experience, firms that specialize in conservation supplies have developed reputations based on their willingness to provide information and dependable products--but you need to know what you want.

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TECHNICAL
LEAFLET

Storage and
Handling

CLEANING BOOKS AND SHELVES

Books should be kept clean at all times. This will significantly extend their useful life. Cleaning should be done on a regular basis, with the frequency of cleaning determined by how rapidly dust and dirt accumulate in book storage areas. It is important to note that cleaning itself may damage fragile bindings, which may not be able to withstand the handling required to clean them. Judgement needs to be used in deciding when to clean books.

The organization of a cleaning project and the procedures used to clean books and shelves will vary depending upon several factors. These factors include the physical condition of the books, the amount and type of soil to be removed (light layer of dust versus heavy accumulation of gritty dirt), the nature of the value of the books (if they are valuable solely for the information they contain or if they have historic, artistic or associational value as well), and the scope of the cleaning to be undertaken (if cleaning is an on-going program intended to maintain every book in the library, or if it is a limited project designed to clean only books in a particular area or collection). These and other factors are discussed in detail by Ann Swartzall in "Preservation," RTSD Newsletter, volume 10, November 7, 1985. What follows here is a general discussion of basic cleaning procedures.

In order to reduce the amount of dust and dirt that accumulates on books and shelving, floors in book storage areas should be kept as clean as possible. Floors should be vacuumed regularly. Sweeping is discouraged because it tends to stir up and scatter dirt. Floors should be washed and carpets cleaned when needed. It is essential that precautions be taken to prevent books on lower shelves from being splashed by cleaning agents.

Shelves are best cleaned with a magnetic wiping cloth, which attracts and holds dust with an electrostatic charge. This cloth is sold commercially as the Dust Bunny® and the Dust Magnet.® Two alternatives are the One Wipe® dust cloth, which has been chemically treated to hold dust, and the chemical-based product Endust® sprayed onto a cloth. Feather dusters should never be used because they only redistribute the dust. Heavy dust should be removed with a vacuum. Vacuuming should be done with a vacuum designed to prevent recirculation of dust through the exhaust. Thick accumulations of dust and dirt may require that shelves be washed with a mild detergent. Careful consideration should be made prior to bringing water into book storage areas because of the risk of spillage and of raising the relative humidity in a confined area if many shelves are cleaned at one time. Care should be taken to be certain shelves are completely dry prior to reshelving books, especially if shelves have been cleaned with water. Fast-drying spray cleaning agents that do not require mixing with water may be preferable.

Books should be cleaned by being held firmly closed and wiped with one of the cloths mentioned above. The magnetic wiping cloth is preferable because it does not contain chemicals or other substances that could be left behind on books. If books are covered with a heavy layer of dust, vacuuming may be advisable. A soft brush attachment is recommended. A piece of cheesecloth or screen should be added between the end of the hose and the brush attachment to prevent loose fragments on deteriorated bindings from being sucked into the vacuum. The suction of the vacuum may need to be decreased for this reason. The vacuum should not be used directly on books of artifactual or

associational value. Instead, a soft-bristled brush should be used to sweep dust from the book into the vacuum nozzle. When cleaning books it is important to hold them firmly closed to prevent dirt from slipping down into the pages. Books should be wiped or brushed away from the spine to avoid pushing dirt into the endcap or down into the spine of the binding. The top of the book, which is usually the dirtiest area, should be cleaned first and then the rest of the book wiped or vacuumed. Dust cloths should be changed frequently and the cloths used to clean shelves should never be used to clean books.

Several book cleaning products are available on the market; some are specified for particular types of bindings such as leather, cloth or paper. There are both advantages and disadvantages to the use of these products. Since the magnetic wiping cloth is sufficient for most cleaning tasks, it is probably best to rely on it and avoid use of the book cleaning products. If books in your collection present special cleaning problems, these products may prove useful. Seek the advice of an experienced professional first. In general these cleaning products should be avoided for books of value because components in the cleaners may cause long-term damage to some book materials.

Cleaning is usually most efficiently carried out by two-person teams using a book cart, cloths, and a vacuum. Working one shelf at a time from top to bottom, books should be removed in shelf-order and placed on the cart, using a bookend to support them. The shelf should then be cleaned. Acidic inserts, such as bookmarks, scraps of paper and pressed flowers, should be removed from books so that acidity in the inserts does not migrate into pages and damage them. Paper clips and other damaging fasteners should be removed so that they do not stain or crease pages. Each book should be cleaned and then returned to the shelf in order.

Since cleaning has the potential to damage books, personnel should be taught careful handling techniques. Personnel should also be made aware of the importance of cleaning. Because it is such a basic and time-consuming task, cleaning is often overlooked or postponed. However, it is of critical importance in extending the useful life of collections. By eliminating dust and dirt which abrade pages and binding surfaces, attract insects, and contribute to an environment that supports mold growth, personnel are contributing greatly to the preservation of their collections. This basic task is one of the most important in preserving collections.

Sources of Supplies

This list is not exhaustive, nor does it constitute an endorsement of the suppliers listed. We suggest that you obtain information from a number of vendors so that you can make comparisons of cost and assess the full range of available products.

Dust Bunny® Magnetic Cloth	TestFabrics, Inc. 200 Blackford Avenue P.O. Box 420 Middlesex, New Jersey 08846 (908) 469-6446	Conservation Materials Ltd. 1165 Marietta Way P.O. Box 2884 Sparks, NV 89431 (702) 331-0582 FAX (702) 331-0588
Dust Magnet® Magnetic Cloth	Light Impressions 439 Monroe Ave. P.O. Box 940 Rochester, New York 14603 (716) 271-8960 (800) 828-6216	
One Wipe® Dust Cloth Endust®	Available from hardware or grocery stores	
Triple filtration system vacuums	Available from suppliers of computer room cleaning equipment	

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Preservation

Ann Swartzell, Column Editor
The New York State Library

This column intends to offer general summaries of ideas and practices relating to the preservation of library materials. It is not intended to comprehensively cover an individual topic, but encourage new thoughts on a range of library activities. Comments and suggestions are welcomed.

Let there be no doubt about it, the following is a description of the nitty-gritty side of library work—stack cleaning. Emptying shelves of books, cleaning the volumes and the shelves, and reshelving seem very straight forward and simple. Anyone actually doing it quickly realizes how time-consuming it is. Thus the task is often written off as something everyone would like to do, but that never seems to get done. A few observations on the process of cleaning, including planning, procedures, and results, are offered here.

A first point is whether cleaning is to be on a project or program basis. In this case, I am defining a project as an operation with a clear goal; with the decision to reach that goal, all available resources are used as necessary. A program, by contrast, is intended to be ongoing, eventually reaching its goal. For example, a cleaning project may set out to clean all the volumes in a collection during summer recess, pulling labor resources as necessary to complete the task. A program would assign X hours of labor to cleaning and, from that work, decide how to allot further labor resources. Either approach is a useful attack on the problem of cleaning, but it is important to recognize this difference in approach. Cleaning may also be construed as a component of another project, an approach that should be viewed with caution. If collection inventory or condition survey is the actual project goal, do not become bogged down in cleaning routines and lose sight of original intent.

Deciding what the procedure of cleaning will be is the next order of business; this should be based on the condition of the stacks. Dusting, vacuuming, and washing are the basic procedures from which to choose, with a range of possibilities for implementation. In some cases, it may be appropriate and necessary to provide extra cleaning for individual volumes based on binding materials.

DUSTING

Using a treated cloth will capture dust and allow its removal from the stack area instead of merely redistributing it. The One Wipe® dust cloths have been found not to leave harmful residues when used to dust books; these cloths are washable and may be re-used about twenty times. The product Endust® sprayed onto a cloth of your choice is also suggested. Generally available dusting cloths are often treated with lemon oil, which is helpful to wooden furniture but not to books and should be avoided. When using any treated cloth, do not leave the cloth on the library materials for an extended period of time. When dusting a volume, hold it tightly closed to keep dirt from being forced into the text block as the dusting cloth moves over the edges. Always be sure to move the dusting strokes away from the spine area to avoid driving dirt into the binding margin. It should be made clear to staff that the dirty cloths must be changed to prevent grinding dirt into the volumes. Heavy concentrations of dust on volumes are better approached using a vacuum cleaner, followed by dusting with the treated cloth. Where shelves themselves are encrusted with dirt, washing may be the most efficient approach.

VACUUMING

Almost any vacuum cleaner may be used for stack cleaning, though some are more easily handled and some may require simple adaptation. Floor models need enough flexible hose length to reach up and into the shelves to be cleaned. Portable, shoulder slung models may be helpful in maneuvering in the close confines of stack ranges, but are not necessary. A soft dusting brush attachment is necessary; Carolyn Horton's book *Cleaning and Preserving Bindings and Related Materials* (Chicago: ALA, 1969) suggests adding cheesecloth layers in the dust brush to avoid pulling up pieces of loose bindings. The suction of the vacuum hose may need modification for this same reason, and often a small adjustment valve is provided. Vacuum cleaners with disposable dust bags are recommended for efficiency and ease in getting dirt out of the library; whatever the dust collecting device used, it is necessary to monitor the levels of dirt collected very carefully and keep the machine operating well. The noise of the vacuum cleaner is probably the most disturbing element of these cleaning routines and must be considered in planning work in open stack and study areas.

WASHING

Any process bringing water into a stack area must be carefully considered. The source of the water, distance to be carried and potential for spilling as well as general elevation of the relative humidity in the stacks must be weighed against the value of washing—is it the best choice? For shelves that show evidence of mold, washing with a household disinfectant such as Lysol® is recommended, and is a case where washing is clearly the best choice. Damp sponges and no-rinse spray cleaners may be sufficient for shelf cleaning, where dusting and vacuuming are not enough. Thorough drying before reshelving is the most important step to conclude any washing procedure. Book washing is not recommended as something to be done in the stacks. Any individual volumes found heavily encrusted with dirt or mold should be referred to special care routines.

FURTHER TREATMENT

Because a wide range of materials has been and is used in binding library materials, there is no one cleaning procedure that may be recommended. Buckram, one of the most common binding materials, is best cleaned with a treated dust cloth, or a damp cloth if very dirty (with care to avoid excessive moisture that may cause colors to bleed or cloth to swell.) Library supply catalogs sometimes carry a book cleaning product that could be used on these covers, but it is probably not any better than the dust cloths.

Leather bindings and their treatment are a point of much discussion in the library preservation/conservation world. There are several leather dressing recipes available commercially or from conservators. For a general cleaning project as discussed here, leather-bound volumes in good condition (where the leather is not powdery) should be set aside for further consideration. Dessicated leather, the infamous "red rot" volumes, may be helped by certain acrylic sprays, but more clearly are rebind or protective enclosure candidates.

Some writings on the subject of stack cleaning advocate use of strong fungicides and disinfectants (formalin, thymol, etc.) for the treatment of dusting cloths used on volumes in the stacks. At this time, use of these solutions is not advisable except under controlled conditions. For general stacks cleaning procedures, their strengths are not needed and their use may be hazardous. Dry cleaning, using Opaline[3] cleaning pads or art gum erasers, may be useful for some volumes but this procedure is not generally appropriate for general stacks cleaning projects.

A few further points on equipment: Book trucks capable of holding a whole shelf of books are most practical. Extension cords will probably be necessary for using vacuum cleaners. Cleaning shelves requires seeing the shelves, calling for either step stools of sufficient height or removal of shelves.

The most pressing concern of many library administrators towards stack cleaning is not the procedures or equipment involved but the labor costs. Some results are shared here; please send information about similar projects or programs to the column editor.

A project at the University of Michigan's Fine Arts Library included removing a shelf of books, dusting shelves with treated cloths, vacuuming the tops of books on a book truck, wiping each volume (head, tail, foredge, spine, and front and back covers) with untreated cheese cloth and reshelving. The stack workers moved in teams, generally one on each side of a double-faced range; certain problem volumes (loose boards, torn pages that are obvious, etc.) are shelved spine down for review by a supervisor. Nancy Elkington of the Preservation Department noted that the team effort was for security as much as anything, but it probably had a positive impact on progress, too. This approach used 402 hours to clean the approximately 50,000 volumes on 1,836 shelves of that library, for a labor cost (including stack workers and team supervisors) of $.027/volume. This was done as a special project, but it is hoped that a program in the Preservation Department will continue the coverage.

In the library of Yale's School of Forestry and Environmental Science, a student was hired as summer help for a stack cleaning project. Progress has been slow to date, but the goal is to wash shelves and dust and vacuum as many volumes as possible from the collection holdings of 130,000 by the end of the summer.

In the library of Yale's Classics Department, I was able to clean approximately half of the library's total collection of 19,000 volumes in forty-five hours. This procedure included vacuuming books removed to a book truck, vacuuming and damp cloth cleaning the shelves, and reshelving. Differences here compared to the Michigan figures may be due to isolation of the workers; it is very monotonous work. More people, especially working in team efforts, may be the most productive approach.

A point sometimes raised is why this cleaning should be a special responsibility of the library anyway—why not include it as a general facility housekeeping routine? As Susan Swartzburg explains (*Preserving Library Materials*, Metuchen, N.J.: Scarecrow, 1980), library housekeeping is an overlap function of maintenance staff and librarians. If regular janitorial staff assume this responsibility, it should clearly be under the continuing advice of the librarian. Products and procedures have been known to change too quickly, dependent on resources of a supply house, and industrial cleaning products new to the market may not be appropriate for use on books.

Whether beginning as a project or a program, time to complete cleaning of one collection is of interest. The Classics Library at Yale aims to clean one half of its collection each summer; the Lenin State Library of the USSR dusts the entire collection twice a year (Galina S. Rozkova, "Hygiene and Restoration of Book Stock at Libraries," *Restaurator* 1:191–97 (1970); the Columbia University Libraries *Preservation Handbook* (1980) recommends a 3–8 year cycle for cleaning a collection, depending on the size and value of the collection as well as local use and environment. This leaves much room for individual variation on the theme of stack cleaning.

NNPD Guidelines for Using Vacuum Cleaners

Vacuum cleaners are tools that are available for use during holdings maintenance and other preservation work for cleaning shelves, the exteriors of archives boxes and selected records. Dusting brushes or dust cloths must be used when a vacuum cleaner is not safe or appropriate for the task at hand. The decision to use a vacuum cleaner should be verified with the project supervisor before cleaning begins. The following guidelines describe techniques for using and maintaining vacuum cleaners and also specify the manner in which they may be used with records.

Materials and Areas to Vacuum

Records

1) Use a vacuum cleaner to dust the top edges of heavy weight index cards following the techniques described below and in the NNPD Guidelines for Rehousing Index Cards. Do not vacuum index cards that are badly damaged or that are on light weight paper.

2) Use a vacuum cleaner to dust the exteriors only of bound volumes in good condition. Do not vacuum volumes with loose or detached spines, loose labels, or covering materials (such as flaps of leather) that are lifting from the boards. Similarly, do not vacuum textblocks that have index tabs or loose pages extending beyond their edges.

3) Never use a vacuum cleaner to dust loose records, maps, posters, photographs, or other similar records not protected by rigid covers.

Storage Containers

1) Use a vacuum cleaner to dust the exterior of archives boxes. Take care not to damage or remove loosely attached box labels.

2) Never use a vacuum cleaner to dust records within a box.

3) Remove each box from the shelf and place it on a book truck or table before vacuuming it. Do not try to force the vacuum cleaner hose between boxes on a shelf or between the top of a box and the shelf above it.

4) Use a vacuum cleaner to dust the exteriors of storage containers such as trays with lids. Never use a vacuum cleaner to dust roller drawers or Woodruff boxes that still contain records.

Shelves

1) Use a vacuum cleaner with the long oval brush attachment to dust shelves that do not contain records.

Techniques for Using Vacuum Cleaners

General Pointers

1) Use only appropriate outlets, extension cords, and adaptors for the vacuum cleaner. If necessary, ask your supervisor for assistance in identifying appropriate electrical accessories and in addressing all matters of safety.

2) Be aware that the vacuum cleaner has a tendency to pivot while it is resting on a truck or table during work. Therefore, before you begin to vacuum, arrange your work space so that records are not in danger of being damaged by the movement of the machine.

3) Also before you begin to work, be sure that records (especially loose papers) are not positioned so that they will fly about if exposed to the strong exhaust of the machine.

4) When vacuuming, move the brush lightly over surfaces, allowing the suction of the vacuum cleaner to pick up and remove dirt. Do not move the brush forcefully across or scrub against the surface to be dusted.

Index Cards on Heavy Weight Paper

1) When vacuuming the top edges of heavy weight index cards, use the round brush attachment.

2) Move the brush parallel to the card edges. Lift the brush slightly at the end of each motion across the cards before continuing to dust the next section of cards. Slightly overlap the previous path of dusting to ensure that all the dust is completely removed. Avoid dragging the brush across the cards, which could be damaging.

Bound Volumes

1) When vacuuming the exteriors of bound volumes, use the round brush attachment.

2) Before vacuuming, lightly compress the textblock pages.

3) During vacuuming, hold small volumes securely in your hand. Support large or heavy volumes on a table or book truck.

4) To vacuum the covers and the spine, lightly follow the contour of the volumes with the brush.

5) To vacuum the top and bottom edges of a volume, begin at the spine and move the brush outward. Keep the motion of the brush parallel to the page edges.

6) Never use the vacuum to dust endsheets or other pages within a volume.

Care and Maintenance of Vacuum Cleaners

1) Clean brush attachments on a regular basis by removing the brush from the hose and using the suction of the vacuum cleaner to remove loose dirt and debris from the brush.

2) Remove oily or sooty dirt by washing the brush with soap and water. Allow the brush to dry thoroughly before reusing it.

3) Check the vacuum cleaner bag periodically and replace it as necessary to keep the machine functioning efficiently. (Bags are available from NNPD.) Replace the bag in an area that is far removed from records and carefully dispose of the full bag.

4) At the same time that you replace the bags, wipe clean the inside of the vacuum cleaner and the end of the soft hose attachment with a damp dust cloth.

MLR KG
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Microforms in Libraries

A Manual for Evaluation and Management

by committees of the
Reproduction of Library Materials Section and Resources Section
Resources and Technical Services Division,
American Library Association

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3 Collection Management

Arrangement of the Collection

The microform collection should be arranged in a manner which makes it easy to use and maintain. Microforms should be divided by form (roll film, fiche, card) and stored in clearly labeled cabinets or on shelves. The system used for arranging the collection and for identifying materials in sets should be simple. Standard classifications such as Dewey or Library of Congress were often chosen in the past. They are not currently recommended, however, because browsing is not a significant factor in microform use. A system which arranges materials by format and within format by consecutive numbers results in expansion in only one part of the collection, thus reducing the need for shifting. Establishing a separate sequence for continuations may be desirable for large collections. Libraries with microforms in several locations (e.g., branch libraries or special collections) will need to prefix call numbers with a location symbol. Using this system, a sample call number would be as follows:

PSL	(optional location symbol)
Film	(format)
S	(serial)
13	(the thirteenth serial acquired for the microform collection)

Depending on the availability of staffing and the degree of security needed, access to the collection may be either open or closed. Open access can save staff time. A clear plan showing the arrangement of the collection and staff assistance in locating materials are essential when users have direct access to the collection. Some materials, such as items subject to theft or mutilation, may need to be kept in a controlled collection that is accessible only with staff assistance. Closed access provides greater security,

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greater assurance of the availability of materials, and more personal service to the user.

Intershelving microforms with other library materials is an alternative for smaller collections. It brings materials in microform to the attention of browsing users. A serious disadvantage of intershelving, however, is the concomitant dispersion of microform reading and printing equipment in the library. This dispersion makes assistance to the user, maintenance of equipment and materials, and environmental controls difficult and expensive.

Storage

Microform storage areas should be designed to preserve the collection and provide efficient access. They should be located as close to the service area as possible and arranged in such a way that heavily used titles can be retrieved quickly. Steel filing cabinets are most desirable for storage of roll film and microfiche because of the superior packing density and convenient access they provide. They are especially convenient for heavily used titles such as the *New York Times*. A less efficient but adequate and far less costly alternative for roll film is the use of inert plastic or cardboard containers (six to twelve reels of 35mm film per container) stored on regular library shelving. Care should be taken that no corroded metals or corrosive paints are present in filing cabinets or on shelves. Microfilm should be wound on inert plastic reels and stored in individual acid-free boxes. Storage containers and individual reel boxes should be labeled clearly with the title, volume numbers, publication dates, and call numbers of their contents. Film should not be wound too tightly or too loosely on the reel, and rubber bands should not be used to secure the film since they may emit damaging sulfur compounds. Acid-free button-and-tie wrappers should be used instead.

Microfiche should be stored individually in acid-free envelopes which fit into storage cabinets without buckling. The back of the envelope should extend above the fiche header area so that identifying information printed on transparent headers can be read easily. Filing guides and reinforcing dividers should be made of acid-free materials, and care should be taken not to compress microfiche too tightly in cabinet drawers.

Temperature and relative humidity levels in microform storage areas should be constant. No more than 5% fluctuation should occur in either during any 24-hour period. The recommended temperature range is 50°-70°F (10°-20°C). Relative humidity range should be within 30%-50%. If temperature or humidity is higher than the recommended levels, the collection will be susceptible to fungus, blemishes, sticking, and chemical deterioration. Temperature and humidity which are lower than recommended levels can cause brittleness. Rapid temperature changes

should be avoided, since the resulting condensation can cause film emulsion to swell and damage the image.

Master negatives should be stored separately in fireproof cabinets or vaults. It is good practice to store masters in a different building so that new copies can be made from them in the event that the service collection is damaged or destroyed by fire or flood. Special care should be taken to ensure constant temperatures of 65°F (18°C) or lower, and humidity levels of 35% ± 5%. In no case should temperatures be allowed to rise above 70°F (21°C). Dust control is also important. Camera film or printing masters should be used only to produce service copies and not for reading purposes.

All microforms should be stored away from radiators, sunny windows, and heating vents since heat and light can cause image deterioration. Water damage can often be avoided if the collection is stored at least six inches above the floor and away from fire sprinklers. Roll film that has become wet should be immersed in plastic containers of clean water and sent immediately to a photographic laboratory to be dried.

Inspection of Incoming Materials

As described in an earlier chapter, orders for microforms should include format, polarity, image position, image sequence, packaging, and labeling specifications. Once new microforms have been received in the library, they should be inspected immediately before processing the vendor's invoice for payment and before sending the material to the processing department for check-in and cataloging. Full, detailed discussion of acceptable microform quality is given in Pre-order Considerations and Ordering, pages 6–7, but sometimes practical considerations dictate a brief preliminary inspection to verify that the material received is the material ordered and that there are no obvious deviations from expectations in packaging or in the microforms themselves. Inspection equipment (reader, rewinds, magnifier, microscope) need be used only when obvious shortcomings are noticed.

Basic inspection procedures include the following.

Verification of:

- title
- quantity and/or coverage (number of reels and volumes, dates covered, etc.)
- format (fiche, 35mm film, etc.)
- film type (silver halide, diazo, vesicular)
- polarity (positive or negative)
- image position and image sequence

Evaluation of:

- image contrast (sufficient legibility)
- microfiche envelope (size, construction, type of paper)

microfilm box (size, condition, type, labeling)
microfilm reel (type, condition, and winding method)
microfiche header (information given, legibility, etc.)

Physical Processing

Physical processing of new acquisitions is necessary to ensure that new microforms are identified as library property and are made ready for storage and use. Typically, the following steps are involved.

1. *Roll microfilm.* Determine whether there is adequate leader and trailer (i.e., at least 18 to 20 inches); if there is not, return the film to the vendor or, if that is impractical, splice on blank film. Check to see that the film is correctly wound on an inert plastic reel which is in good condition. Replace the reel and rewind the film as needed.

Apply an ownership mark to the leader by means of perforation or with a film-marking pen, and add the call number or other identification if desired. Although labels are easily applied, their use is not recommended because the adhesive may damage the film or reader. Check to see that the film is snugly but not too tightly wound, remove rubber bands, and secure the film with an acid-free button-and-tie wrapper.

If the storage box in which the film arrives is not acceptable (i.e., is not made of chemically inert materials, is a nonstandard size, is in poor condition, or is improperly labeled), exchange or relabel it as necessary.

Make the necessary statistical count.

2. *Microfiche.* Examine the envelope in which the fiche arrived to determine whether it is of proper size, construction, and material. Add the property marking and, optionally, the call number or other identification information to the envelope. Title and date of receipt may also be added. If the fiche arrives without an envelope or a replacement envelope is needed, use a chemically inert envelope of proper size and construction.

Alternatively, a call number or other identification and ownership marks may be added to the microfiche by using a pen which writes on film. This method, although time-consuming, is preferable to using adhesive labels. Labels add bulk to the file, and their adhesive can damage microfiche.

When several fiche are kept in one envelope, it may be necessary to place a sheet of acid-free paper behind the first fiche to make the information on the headers legible.

Make the necessary statistical count.

3. *Micro-opaques.* Put an ownership mark on the material and on the container.

Make the necessary statistical count.

Collection Maintenance and Repair

Preventive maintenance is essential to keeping the microform collection in good condition. The library's maintenance program should include proper care and repair of reading and printing equipment, frequent vacuuming and dusting of reading and storage areas, maintenance of recommended levels of temperature and humidity, and use of proper storage containers and cabinets. Staff and users should be instructed to handle all microforms by their edges since acid from skin can damage film, and fingerprints can obscure images

Shelves should be read regularly and microfiche cabinets sampled for filing errors. Regardless of whether access to the storage area is open or closed to the public, microform reading area staff should do all refiling. A good method for avoiding improperly wound reels is to use locking take-up reels on all reading and printing equipment.

A regular inspection program should be established to review the condition of the collection and to identify problems such as dirty, scratched or torn film, and evidence of fungus or other blemishes.

Microfilm can be torn in even the most carefully maintained collections. Special mylar splicing tape is available for emergency repairs. Ordinary cellophane tape should never be used for repairing torn film because the adhesive can damage both film and reading equipment. If the torn film is heavily used or if it shows evidence of other damage such as extensive scratching, it should be replaced. If replacement is not possible or practical, repairs can be made with a heat weld or ultrasonic splicer; splicing, however, may result in the loss of several pages of text since microfilm often tears lengthwise. If film is spliced, it is a good idea to caution the user by stamping the box with the warning "Spliced Film—Please Handle with Care" and to indicate on the box which pages are missing.

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Reformatting

MICROFILM AND MICROFICHE

Microforms (microfilm and microfiche) have become an established preservation strategy. They permit access to information that might otherwise be unavailable because the original artifact is vulnerable to damage or loss through handling. Because microforms can be sensitive to damage, good planning for all aspects of their care and handling is important. Their storage and handling requirements have much in common with other photographic materials.

MICROFILM TYPES

Three types of film are most common in microform collections: silver-gelatin, diazo, and vesicular.

These films come in a number of formats. The most familiar are 16- or 35-mm roll microfilm and microfiche, which resembles a plastic file card. Film can be cut into short strips and housed in clear jackets to produce a microfiche format.

Silver-gelatin (silver halide) films. These are based on the familiar technology of black-and-white photography, and are the only microform medium that is appropriate for archival purposes. The image is produced by exposing light-sensitive silver compounds in a film emulsion to light. The resulting image is chemically developed but harmful chemicals are washed out in processing. The original (master) silver-gelatin microfilm is almost always a negative image, but positive or negative secondary copies can be made. While some early microfilm had a cellulose nitrate base, contemporary film bases are acetate or polyester. Only polyester is recommended for preservation filming. The emulsion side of this film is matte, while the non-emulsion surface is glossy. Modern silver-gelatin films are long-lived under appropriate storage conditions and normal library use.

Diazo films The emulsion layer of these films contains diazonium salts that combine with dye couplers to produce strong dense colors. Exposure to UV light causes the salts to decay and lose this coupling capacity. In the diazo process, film is exposed by contact printing from a master. Acids used in the emulsion to prevent the coupling reaction are neutralized by exposure to a strong alkali (usually ammonia), and dyes form in unexposed areas of the film. The image duplicates the master directly. Diazo film is available in a variety of colors, including black. It may have an acetate or polyester base, although polyester is increasingly popular because of its stability and resistance to environmental factors. Resistance to fading depends on the choice of salt and dye coupler; black requires a combination of dyes. Processed black diazo resembles silver-gelatin film but is glossy on both sides. Diazo film is reasonably stable but eventually fades, even in the dark. Fading is speeded by prolonged light exposure (as in a reader).

Vesicular film. This medium takes advantage of the fact that diazonium salts produce nitrogen as they decompose on exposure to UV light. In vesicular films, diazo emulsion is sandwiched between two base layers. The film is exposed via contact printing from a master, and the image is developed by heating the film. This momentarily softens the base material, and causes expanding nitrogen to form tiny pockets (vesicles) that remain when the film is cooled. Typically, residual photosensitive material is then fixed by exposing the film to UV light

(causing complete decay of the diazonium salts). Transmitted light passes through the flat film and emulsion but is scattered by the bubbles, causing vesicular areas to appear dense. Reflected light causes flat areas to appear darker than vesicular areas. Vesicular film can produce a positive or negative image, depending on the steps in post-exposure processing. The image will always exhibit slightly raised areas. The film base is always polyester because acetate cannot tolerate the heat used in processing. The major flaw in the durability of vesicular film is the movement of the base material at high temperatures. Vesicular film may suffer damage at temperatures below 167°F, which is the ANSI-permissible temperature for film readers.

Color Microfilm. Color microfilm and microfiche are available from a few vendors, but very little is known about their potential for preservation use. Only one color transparency (positive color) film, Ilford Cibachrome, is considered promising for preservation. This film, unlike all others currently available, has color layers built directly into its emulsion. Testing at the Image Permanence Institute (Rochester, New York) suggests that the life expectancy of the dyes is excellent when the film is not exposed to light, but that its polyester base may be less resistant to deterioration than others. No testing of light stability (important to estimate permanence in use) has yet been done. Several experimental color microfilming projects were still underway in 1992. No standards exist for color microforms and they are not yet recommended for long-tern preservation. Cibachrome may be as much as ten times more expensive than black and white microfilm.

STANDARDS

Microforms used for long-term preservation of information require careful production and examination in addition to well-controlled storage and handling conditions. Collections that use microforms should establish specifications and inspection procedures to insure that vendors provide films to meet their use and preservation needs. ANSI/AIIM standards and specifications developed by the Research Libraries Group of the American Library Association (see bibliography) and the Library of Congress are useful guidelines. Each institution's requirements will differ, but they should be contractually specified and systematically monitored to protect both collections and the institution's interests.

STORAGE ENVIRONMENTS

Temperature and relative humidity. In general, microform requirements resemble those of other photographic materials. Year-round relative humidity lower than 50% is recommended for all film types. An upper limit of 40% is recommended for silver-gelatin films to minimize the likelihood of microscopic blemishes from silver oxidation ("measles"). Temperature must not exceed 70°F; cooler temperatures are preferable. Master films should be stored at maximums of 65°F, 35% RH, ±5%. ANSI standards PH 1.43 - 1983 and PH 1.53 - 1984 specify exact conditions for archival storage of film.

If low temperatures are maintained for the storage of use collections, and readers are located outside storage areas, a conditioning period is required to allow gradual warming of cold films before they are read. Rapid transfer from a cold to a warm space may cause water condensation on the surface of the films.

Dehumidification systems should be refrigerant-based. Desiccant-based systems can generate fine dust particles that may scratch the surface of films. Desiccant-charged storage cabinets are not recommended; the relative humidity in such a system is difficult to monitor and control, and dust may abrade film surfaces. If humidification is required to stabilize fluctuations in the storage environment, it should be derived from a system with a contaminant-free water source. Corrosion inhibitors used in many large-scale systems can leave reactive deposits on library and archival materials. Film is particularly susceptible to chemical and abrasive damage from this source. Trays of water or chemical solutions should never be used to humidify storage cabinets.

As in the case of paper artifacts, fluctuations in temperature and relative humidity must be controlled for long-term preservation. Relative humidity and temperature for microfilm collections in use should not vary more than ±5%, and ±3% is preferable. The cooler the storage, and the better controlled the relative humidity, the longer the expected life of the films.

Pollution. Particulate air pollutants are an obvious source of scratches and abrasion for microfilm. Silver-gelatin films are most vulnerable to such damage. Housekeeping, including regular vacuuming, is important in storage and use areas.

Gaseous air contaminants such as oxides of sulfur and nitrogen, paint fumes, ammonia, peroxides, ozone and formaldehyde damage film bases and emulsions. They may produce oxidizing or reducing effects that cause microblemishes on silver-gelatin films. Films should not be stored near photocopiers, which may be a source of ozone. Films should be removed from any area to be painted. Good air circulation should be provided by fans and open windows, and the paint should be allowed to cure for three months before films are returned to the space. Wooden shelving or cabinets should not be used in areas where microforms of long-term value are stored.

Diazo and vesicular films and silver-gelatin films should not be rolled on the same spools, sleeved in the same enclosures, or (ideally) stored in the same containers. Space and access problems usually make separate cabinets for different film types impractical, but separate spools and fiche sleeves should always be used. In addition, older vesicular films may be a source of acidic deterioration products. They should be physically separated from other films and systematically replaced.

MULTIPLE COPIES

While perfectly controlled storage environments are ideal, multiple copies of microforms can provide a pragmatic solution for archival preservation. Most collections with films of enduring value use a three-level system to allow some flexibility in storage requirements:

Master negative. The first generation film (master negative) should be a silver-gelatin negative print produced from the original artifact and processed according to standards given in ANSI/AIIM MS23--1991. This is the archival copy, which is used to produce a duplicate negative (below) for the generation of use copies. The master negative should be stored in a different location from secondary copies, under conditions as close as possible to the ideal. There are a number of repositories that rent space for archival storage of microfilm. These are recommended, but the user should be sure the storage conditions meet ANSI standards (PH1.43-1983, PH1.53-1984). The only subsequent use of the master negative should be the reproduction of a duplicate negative lost to damage or disaster.

Duplicate negative. (duplicate master). This copy is usually silver-gelatin or diazo, since vesicular film does not provide the same resolution and crispness. The duplicate negative is used to generate use copies for the collection. It should be stored under the best available conditions, since it serves as a working master to protect the master negative. Ideally, it should be physically separate from use copies.

Use copies. Any of the available media or formats may be acceptable, and images may be positive or negative. Good storage and handling will extend the life of use copies, protecting previous generations of microform.

STORAGE ENCLOSURES

Since it is difficult to completely remove gaseous contaminants with available technologies, it is extremely important to enclose films well. If master negatives must be stored in poorly controlled environments, sealed metal cans or inert plastic containers may provide a solution. Kodak publication D-31, Storage and Preservation of Microfilms (Eastman Kodak Company, Rochester, New York 14650), provides useful guidance for the use of sealed containers. This strategy is not a panacea and must be used judiciously. Cans must meet chemical composition requirements; cans should not be roughly handled, or film can be distorted on reels; and it will be necessary to examine the film and return it to the conditioned cans periodically to make sure no deterioration is occurring. It is preferable to use acid-free boxes and string ties, then to store master film in a temperature controlled facility (see below).

Enclosures should be chosen following established guidelines for archival storage. Since the effect of alkaline buffers on photographic materials is still being investigated, we recommend that paper enclosures be of high-quality, acid-free, lignin-free, neutral paper. However, if the RH of the storage environment is stable and below 50%, buffered enclosures should present few, if any, problems. Where possible, adhesives should be avoided. "Safe" plastics (polyester, polyethylene, polypropylene, but not PVC or vinyl) are acceptable. Microfiche should be sleeved with the emulsion side away from interior enclosure edges to prevent abrasion; this also adds protection from adhesives on sealed edges. Microfilm reels should be individually boxed, with films held by paper ties. Rubber bands must not be used since most contain residual sulfur, a source of film and emulsion damage; pressure-sensitive tape has been discussed elsewhere.

Steel filing cabinets are most desirable for microform storage, but inert plastic containers are acceptable for library shelf use. Microfiche enclosures should fit into drawers without buckling. Dividers and

placement guides should be of acid-free materials. Do not compress fiche in filing, and use space dividers to prevent curling.

Different types of film should be stored in different containers to prevent chemical interactions.

Filing systems should be designed to minimize handling, and storage cabinets should facilitate location and retrieval of the material. Wear is inevitable in use collections, but its speed and severity can be controlled.

USER EDUCATION

Education of staff and users is essential. Since acidic oils and fingerprints can damage films, gloves should be worn when handling master or duplicate negatives. All films should be handled by the edges or leaders. Only one microform at a time should be removed from its enclosure. Fiche should be resleeved immediately after use; film should be reboxed. Rolled film should never be pulled tight on the reel; this can cause abrasion. Paper bands should be used to prevent accidental unreeling of films.

EQUIPMENT

Ease of use and maintenance should be considered in choosing equipment. Microform readers generate heat; ANSI standards specify an upper limit of 167°F for temperature at the focal plain. Some diazo films are damaged at this temperature, and long exposures of small areas of film (e.g. a single frame) should be avoided. Readers must be turned off if the user leaves the equipment. Reader lens size should take into account the reduction ratios used for filming. Preservation microfilming is usually reduced between 10x and 24x, so lens magnification should be in similar ratios. Zoom lenses, which allow for changing magnification, are now available.

Equipment should be inspected weekly and maintained daily. Image quality will be decreased by dirty equipment. A staff member should have assigned responsibility for equipment maintenance and should be trained by manufacturer's personnel. Dust below the screen level will be magnified by the optics of the reader. It can be transferred to the microform, where it can obscure details and damage film. Dust covers should be used religiously. Grime builds up on the edges of glass flats to create another source of abrasion. Glass flats and carriers should be cleaned daily. A regular schedule for cleaning lenses, mirrors, and viewing screens should be established. Instructions for equipment maintenance are beyond the scope of this report. General instructions are given in Francis Spreitzer's Microforms in Libraries (see bibliography).

DISASTER PLANNING

Disaster planning is critical for microform collections. Microforms are highly susceptible to water damage. They must be protected from flooding or burst pipes. Once wet, this material must not be allowed to dry in rolls or enclosures; it will stick to itself and enclosures. Wet microforms must be removed from enclosures. Rolled film must be unrolled. It can be air dried, but it is most efficient to locate in advance a local film processing lab that can provide this service in an emergency. Microfiche can be dried flat, emulsion side up, in single layers, or clipped to a line by an edge that bears no image. Diazo is prone to water spotting, and squeegees or lint-free pads should be used to control beading. Vesicular film is prone to distortion during drying.

These materials should not be frozen or freeze-dried; film layers may separate, and handling damage is difficult to prevent. If microforms cannot be air dried immediately, they must be immersed in clean, cold water and sent to a laboratory for safe washing and drying. Mold growth must be prevented on all film types. Diazo and vesicular films may be cleaned with a slightly moistened lint-free pad; if mold effects silver-gelatin film, seek professional assistance.

CHOOSING A MICROFORM PROVIDER

Commercial microfilmers are often a cost-effective provider for converting books and documents to microform. As stated above, each institution should develop standards for its microfilm, and these standards should be part of the contract for services. It's a good idea to visit the microfilm provider to make sure fire, housekeeping, and security meet the needs of the collections that will be filmed. This is especially important to prevent damage to original materials that will be returned to the collection, rather than discarded.

In some cases a special-service filmer is apropriate. Many objects are filmed because they have become too fragile to survive handling by researchers. If this is the case, or if the institution wants to retain bound materials in the original form, consideration should be given to using a special-service filmer. High-volume commercial microfilmers lack the

equipment, time, and expertise to process fragile materials without damage to brittle paper or deteriorated bindings. Costs for special service will be higher, but valuable artifacts or hard-to-film originals (e.g. tightly-bound volumes with obscured gutters or documents with fading or inadequate contrast) may require this expense. NEDCC has extensive experience in special microfilming and can be contacted for estimates or advice.

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**Association for Information and Image Management, 1100 Wayne Avenue, Silver Spring, MD 20910.

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Archives & Manuscripts: Conservation

A Manual on Physical Care and Management

Mary Lynn Ritzenthaler

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Ideally, stack areas should have no windows at all, even if items are boxed. If windows are present, they should be painted over or, preferably, boarded up. Windows in processing areas or reading rooms may be handled differently, in part for aesthetic reasons and human comfort and in part because materials are exposed for relatively brief periods of time. Windows in these areas should be outfitted with UV-filtering shields, which are available in rigid sheet form (such as Plexiglas® UF3) or in thin rolls that can be applied directly to the insides of windows. As an intermediate step—or a further precaution—window shades, blinds, or opaque curtains may be used to limit the amount of sunlight entering the area. Architectural features, such as eaves or overhangs, also may be a help in this regard. Another means of reducing the level of ultraviolet radiation in archival quarters is to paint walls and ceilings with paint containing UV-absorbing zinc white or titanium dioxide. Light (from any source) reflected from surfaces painted with these pigments contains little ultraviolet radiation.

Fluorescent light tubes should be covered with UV-filtering sleeves; these are flexible plastic covers that contain a UV-absorbing material and that slip directly around the fluorescent tubes. Despite manufacturers' claims, UV-filtering screens do not last indefinitely. They must be changed on a periodic basis; every 7 to 10 years is recommended. Fluorescent tubes that have been coated directly with a UV-absorbing material also may be purchased, though they are a more costly alternative. Maintenance crews, if not supervised, may unintentionally discard UV-filtering sleeves or replace coated tubes with regular fluorescent lights. In some large institutions, outside firms are hired to change fluorescent lights on a regular basis. As such service contracts are fulfilled throughout institutional offices and buildings, special archival concerns may be forgotten if the archivist is not vigilant. While UV filters and coated fluorescent tubes must be replaced periodically, it is not cost-effective to discard them prematurely.

Incandescent lights pose no significant threats to archival materials from ultraviolet radiation, and thus are the preferable light source in archives. Despite the fact that incandescent lights are somewhat more costly to operate than fluorescent lights (and many institutions have switched to the latter for this reason), good arguments may be made on behalf of incandescent lighting. First, there is generally no reason to have lights constantly on in stack areas. If incandescent lights were turned on only when material had to be retrieved or refiled, there would be an energy savings in addition to reducing the threat to the materials from light damage. Further cost savings would result because no filtering devices would be required. Over time, this could effect a substantial savings, since filtering sleeves must be replaced periodically. The primary concern with incandescent light is the possibility of heat buildup; this problem, however, is associated with incandescent bulbs in enclosed areas, such as exhibit cases, and would not be a problem in stacks or processing rooms.

New lighting found in many reading and exhibit areas, particularly those with high ceilings, may include high-intensity quartz lighting. These lights should be checked for their UV, blue, and violet-blue contents, and retrofitted with appropriate filters if needed.

As a general practice, light levels in archives could be lowered substantially both by keeping lights off when they are not necessary and by reducing the wattage. When fluorescent lights are used they are generally installed to the point of excess; lighting systems should be adjusted to allow turning off every other range. Timed shut-off switches also should be considered for storage and stack areas.

Actual light levels within the archives (and especially in exhibition areas) should be monitored. Meters that measure both visible and ultraviolet light are available, although the latter are costly. Some photographic light meters may be used to measure foot candles. Assistance in monitoring levels of ultraviolet radiation may be sought from local art museums, universities, or lighting engineers.

Housekeeping

Housekeeping practices in the archives have great impact on the preservation of collections. An atmosphere of orderliness and cleanliness is a positive impetus to maintain good conditions, and creates a positive impression with visitors and donors. Clean surroundings also discourage insects and rodents from settling into the archives. Further, housekeeping activities provide an opportunity to observe conditions throughout the repository and note problems (such as harmful shelving practices) that otherwise might go unnoticed.

Food and drink should be strictly prohibited from the archives storage, processing, and reading areas. Kitchen facilities and staff lunch rooms should be kept scrupulously clean and should be sufficiently removed from areas where archival materials are stored and used. Accidental spills can damage or stain archival records and, equally important, crumbs and garbage will attract insects and rodents. Insects can be a particular problem in tropical climates, but they are a potential threat in any archival repository no matter its locality. At the first sign of insect or rodent infestation, action must be taken. The services of a qualified licensed exterminator should be engaged; and it also may be useful to consult with an entymologist from a local university or natural

history museum if insects cannot be identified. Any chemicals that are used in archival settings must be nontoxic to humans and nondamaging to record materials. Chemicals used to control pests should never be placed in direct contact with archival materials, nor placed in archives storage boxes.

Stacks and storage areas must be kept clean of debris and any material that is extraneous to collections. An ongoing program of dusting shelves and boxes will help to control the amount of airborne dirt that can settle into boxes and folders. Shelves, storage containers, and the exteriors of bound volumes may be cleaned with treated dust cloths (One-Wipe® cloths are recommended), or Endust® may be sprayed onto a piece of soft fabric such as cheesecloth. These products are recommended for such uses in archival and library settings; they readily pick up and trap the dirt rather than spreading it around from one surface to the next. Another aid in cleaning shelves, boxes, and bound volumes is a portable tank-type vacuum cleaner, which will remove heavy accumulations of dirt. The suction should be low, and cheesecloth or a piece of nylon screening should be placed over the nozzle to prevent fragments of bindings or paper records from being sucked into the machine. After initial vacuuming, it may be necessary to complete the job with treated dust cloths; very fragile items should only be dusted by hand.

If shelves are exceptionally dirty—or if they have housed mold-infested materials—wet cleaning is desirable. One cup of Lysol® Disinfectant per gallon of water is a satisfactory cleaning solution. The active ingredient in Lysol® is the fungicide o-phenyl phenol. Rubber gloves should be worn, and the shelves should be allowed to dry completely before reshelving collection items.

Any cleaning that is done by maintenance or janitorial staff should be done during regular working hours when the archivist is present to supervise. This is a precaution from several perspectives. Many archives processing areas appear cluttered to the unpracticed eye, and well-meaning janitors may inadvertently discard materials that were intended to be saved. Any water coming into the archives must be carefully controlled. If floors are to be washed or waxed, care must be taken that records storage cartons are not permanently affixed to the floor as the wax dries. (Despite the fact that archivists know that it is not good practice to store boxes on the floor, the practice persists in bulging repositories.) Further, it should be ascertained that any cleaning supplies or solvents used in the archives pose no threat to collections because of dangerous fumes; sensitive photographic emulsions are especially susceptible to damage or alteration from solvent fumes. Products containing oil, chlorine, alum, peroxides, and ammonia should be avoided; paint and turpentine fumes are also destructive. All cleaning supplies should be stored well away from the archives. A final housekeeping concern relates to the security breach that is posed if maintenance staff have access by key to the archives after hours.

Security

Security is an issue that encompasses all aspects of archival work, and should be considered as it relates to processing collections, supervising readers, and providing theft deterrents. In the present context, however, security is an issue that must be addressed in providing a safe environment for archival materials.

The archives building and its perimeter must be evaluated to determine possible routes of unauthorized access or egress. Within a building, the layout of the archives quarters must be evaluated, paying particular attention to windows, doors, and skylights. Emergency exits with crash bars should be outfitted with alarms. Heavy-duty locks should be installed on doors and windows, and the need for window grills or bars determined. Intrusion alarms at doors and windows should be installed and connected to monitoring panels at the security office, local police station, or commercial security firm. The need for motion detectors with remote alarms should be evaluated as well.

If the archives storage, processing, and reading rooms are not all contiguous, patterns of access and use must be scrutinized. Off-site storage facilities must be considered in these contexts as well. Stack areas should be closed to all but archives personnel, with limited access allowed in other parts of the archives quarters. Researchers should always be monitored in the reading room, for example, and any visitors brought into the processing areas should be supervised. The archives should be keyed on its own system separate from the rest of the institution, and key distribution should be limited and strictly controlled. There is no reason for everyone on staff to have access by key or combination to stack or high security areas such as vaults; access to these areas should be on a need-to-use basis. Distribution of keys to non-archives staff should be avoided at all costs. Maintenance or security staff should not have unsupervised access to the archives.[4]

[4]For further information on archival security, see: Timothy Walch, *Archives and Manuscripts: Security*. Basic Manual Series. Chicago: Society of American Archivists, 1977.

6 Storage of Archival Materials

Storage Equipment

The layout of the archives storage area must provide an efficient use of space and meet the physical needs of the collection. Shelves should not be placed directly against outside or basement walls because of the possibility of excessive moisture buildup or actual leaks. Also, shelves should be positioned parallel with the direction of air flow in the room to allow good circulation in and around stacks. If book trucks or ladders are to be used, aisles will have to be large enough to accommodate them. Oversized materials require more aisle space for access and shelving than do smaller record formats. Factors to consider in determining the height of shelving units are ceiling height, proximity to light fixtures or pipes, and potential awkwardness or difficulty of lifting heavy boxes. In a warehouse setting, high ranges of industrial shelving may be used, although safety factors for staff and material must be considered. Heavy-duty ladders that have platforms rather than narrow steps or rungs should be employed wherever transfer cases or document boxes must be lifted to high levels.

Storage systems should provide overall support and protect materials from physical or mechanical damage. Storage areas and equipment must be designed to meet the preservation needs of special record formats, such as oversized material, photographs, bound volumes, and sound recordings. Decisions about these systems should be based on the format and condition of the material, and not on traditional practices that mandate keeping disparate formats in a collection together despite their physical needs. Good intellectual controls, i.e., an inventory and location file, should overcome any resistance to separating a collection into parts to provide for its greater protection.

Good shelving equipment must be heavy-duty, constructed of non-damaging materials, and designed to impose no stress on collections. It is recommended that all storage equipment, including conventional library shelving, industrial shelving units, map cases, and filing cabinets, be constructed of steel with a baked enamel finish. The finish should be smooth, not bumpy or abrasive, and there should be no sharp edges or corners that could function as cutting edges and thus damage material.

Ranges of library and industrial shelving are commonly used in archival settings for storing document boxes, transfer cases, bound volumes, and oversized records. These units should have shelves that adjust vertically to accommodate materials and boxes of varying sizes. To increase their sturdiness, free-standing units should be bolted together as well as to the floor, and they should be equipped with back and side braces to further avoid the possibility of collapse. Shelves should sit on a base four to six inches off the floor to provide an extra measure of protection for archival materials in the event that flooding results in water collecting on the floor.

Wooden shelves are not desirable for the storage of archival materials because of the possibility of pitch, resin, peroxide, and acidic products leaching out and damaging records. Oak, which traditionally has been used for book cases and shelves, has a particularly high formic acid content. Unfortunately, many archives and special collections departments store their treasured volumes and records on beautiful wooden shelves in reception or reading areas. While the decor is pleasing, it poses potential problems for the materials. If wooden shelves are already in use and the likelihood of change is not great, precautionary measures should be taken. Raw wooden shelves should *never* be used. Wood must be properly sealed with two or three coats of polyurethane varnish to prevent lignin and other damaging materials from leaching out. After varnishing, shelves should be "cured," or allowed to dry for several weeks, before material is reshelved. An alternative to varnishing shelves is to line them with heavy (5-mil) polyester to provide a protective barrier between the shelves and the records stored on them. Appropriately sized strips of polyester can be cut most economically from a roll; and the strips may be held in position on the shelves with double-coated tape (the same as that used for encapsulation).

Map or blueprint cases also should be constructed of steel with a baked enamel finish. Drawers should be no more than two inches deep, although shallower drawers (3/4 inch) are preferable. Deep drawers encourage overstuffing and inflict greater mechanical stress on items during retrieval and refiling. Drawers should be outfitted with fabric dust covers or rear hoods to protect the contents from slipping over the backs or being caught up and damaged as drawers are maneuvered. High-quality, heavy-duty map cases are expensive but prove their worth over time. They should have locks, and drawers should roll easily on ballbearings rather than sliding in grooves, which often results in their becoming misaligned or stuck. Map cases also should be equipped with stop devices to prevent drawers from sliding completely out of the unit when they are opened.

The location of shelving for oversized materials is important, whether map cases or industrial shelving are used. Access to and from filing equipment should be

direct and free from obstructions. Filing will be less hazardous if there is room for drawers to be pulled out completely to the stop position. Also, there should be a large flat surface near the oversized shelving unit where folders and items can be placed to expedite filing and sorting.

Filing cabinets serve a number of purposes for archival storage. These, too, should be made of steel with a baked enamel finish. Wooden filing cabinets, wooden map drawers, and containers that have raw wooden interiors should be avoided. Closed wooden containers offer greater hazards than book shelves due to the build-up of decomposition by-products in an enclosed space, whereas open shelves allow these by-products to be diluted in the surrounding air. Filing cabinets should be evaluated to determine if they have any moveable parts that could damage archival materials. For example, back supports or spring-type devices designed to hold contents upright may exert too much pressure on fragile material, or may allow papers to get caught up in the system and thus suffer damage. Potentially harmful features should be removed.

If the archives is the repository for archaic filing equipment as well as historical records, the suitability of the equipment for housing valuable collections must be evaluated. The type of material, finish, and mechanical features must be considered. For example, the action of a drawer rotating open in a circular motion rather than rolling on a flat plane could damage fragile material as it moves about. Spring clamps may exert too much localized pressure on brittle items. Filing equipment that is not suitable for storing archival materials, if it cannot be discarded, should be recycled to other uses, such as storing office supplies.

Storage Materials

All paper and board stock used in conjunction with archival materials, such as boxes, file folders, envelopes, and mat board, should be acid-free and buffered to have an alkaline reserve with a minimum pH of 8.5. In addition, archival storage materials should contain no lignin, groundwood, or alum-rosin sizing. Some photographic materials are excluded from this recommendation, as noted on page 44. Storage materials that have an alkaline reserve are available in a wide variety of standard sizes and formats to meet virtually every collection need. In addition, suppliers are willing—for a fee—to fabricate folders and boxes to specialized sizes. Also available are paper and board stock that allow the skillful archivist to construct custom-made storage units. Acidic filing materials, of which there are endless examples ranging from manila folders to glassine negative sleeves, do not provide long-term protection for archival materials. They are inherently unstable and will break down over time; it is not at all uncommon to see top edges missing from old manila file folders. More importantly, acid will migrate from these enclosures to archival records stored in them. For example, corrugated cardboard boxes emit substantial quantities of peroxides and lignin by-products, which are especially harmful within closed containers.

Some archivists and administrators argue that it is a waste of money to use folders and boxes that have an alkaline reserve on materials that have not been deacidified. There are other ways of looking at this issue, however. The information that is currently available on the damage caused to records from acid—whatever its source—is conclusive. It renders decisions to keep valuable records in acidic containers unconscionable and unenlightened. Further, it is incorrect to assume that all archival papers are inherently acidic; some are quite sound and do not require deacidification. It is a basic conservation principle that any materials brought into contact with a collection must be non-damaging; suspect or nontested materials should be kept away from valuable records. Thus, even a beginning archives can institute sound conservation practice by using only safe storage materials. There is a further, perhaps psychological, advantage to replacing acidic file folders and boxes with containers that have an alkaline reserve: records that show evidence of care and attention will elicit careful handling, while records that look timeworn and sit in ragged dirty folders and boxes give the impression that they have little value to the repository or anyone else. (See Figure 6-1.)

A wide variety of plastic materials are being used to store and protect archival records. The recommended plastics have several positive attributes. They are inert, or chemically stable, and will undergo no changes that will have an adverse effect on material stored in them. Further, they allow clear visual access to records, are strong, and protect fragile materials from mechanical damage that could result from handling. Perhaps the most common plastic found in archival repositories is polyester, often referred to as Mylar®, its DuPont tradename. Polyester is used to encapsulate brittle paper, to construct protective folders, and also has many uses in mounting exhibits. Plastic envelopes and sleeves are being used increasingly for housing photographic prints and negatives. They allow immediate visual access and also protect sensitive photographic emulsions from fingerprints.

Plastics that are safe to use with photographs and other archival materials include, in addition to polyester, polyethylene, polypropylene, and triacetate. The sheets of black paper that are often found within inert plastic sleeves when purchased should be discarded; these sheets are acidic and will damage materials stored

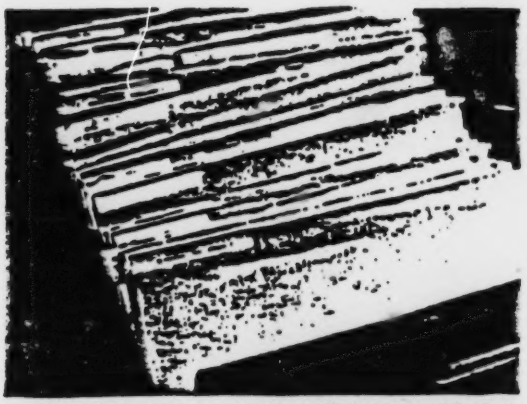

Figure 6-1. This collection would benefit by removal from the acidic and dirty envelopes in which it is stored. Improved storage conditions would also present a better image to researchers and potential donors.

in contact with them. As a precautionary measure, the pH level of any paper inserts in commercial plastic sleeves should be tested before use. Polyvinylchloride, which is used in a number of commercially available photographic albums, sleeves, and slide enclosures, has no place in an archival repository. It is not inert but readily degrades upon exposure to heat and light, emitting plasticizer by-products and harmful gases that are very damaging to records.

When purchasing any storage materials for archival records, it is important to specify the exact requirements of the materials in precise language. American National Standards Institute (ANSI) or government specifications should be cited as appropriate. The term "archival quality" may be used, though it is imprecise. When ordering paper and board stock, pH range should be specified; groundwood papers and those with alum-rosin sizing should be specifically excluded. Orders for plastic materials should explicitly exclude plasticizers, surface coatings, and UV absorbents or inhibitors. It is safest to purchase storage materials directly from reputable archival and conservation suppliers. It is in their best interest to work with both archivists and manufacturers to keep quality high and within recommended specifications. As a precaution, however, it is always wise to double check an order. For example, once a shipment of boxes and paper is received, it is a simple matter to conduct several spot tests to check the pH level (see Appendix B5 for instructions) to make sure it is within the proper range. Orders for all archival storage materials should specify that no substitutions are acceptable. Questions should be raised if problems develop with a product, or if there is any suspicion that specifications have not been precisely honored. Questions may be addressed to both the supplier and the manufacturer; reputable suppliers will correct any problems with new shipments.

It is essential to know exactly what a product consists of before purchasing it. This is a special problem with plastics. It is often impossible to determine the composition of a product from packaging materials or advertising claims. In such instances, clarification (via the product data sheet) should be requested from the manufacturer. Local art, photographic, and stationery supply stores should not be viewed as appropriate sources for archival storage materials. While the paper *may* have an alkaline reserve and the photographic sleeve *may* be polyester, it is unlikely that salespeople will know the precise composition of their product lines. Similar cautions should be taken when purchasing other archival and conservation supplies. The terms "archival" and "archival quality" are commonly used to denote characteristics of permanence and are often included in advertising literature to invoke the impression that products have keeping qualities and non-damaging characteristics. They may indeed, but it is always advisable to evaluate the source and know whether or not products and materials have been independently tested for their safe use with archival records.

Storage and Handling of Specific Record Formats

Archival records exist in a wide range of formats. While they can be preserved compatibly under the environmental conditions described in the preceding chapter, some records have specialized filing and storage requirements because of their physical format or condition. Appropriate storage practices for a number of archival record formats are described below.

Unbound Records

This category encompasses a wide range of materials: correspondence, legal documents, financial records, leaflets, minutes, and broadsides. The list is potentially limitless, and, in terms of their storage requirements, may include pamphlets, publications, and small booklets (such as constitutions and membership directories) as well. Virtually any paper record that meets the size limitation should be stored in file folders and boxes that have an alkaline reserve. Based on collection format and need, many repositories find it advantageous to adopt either legal- or letter-sized supplies and to use them consistently. Such uniformity expedites shelving and filing systems. Envelopes and pamphlet boxes are also useful for filing pamphlet collections and small-format items. Many repositories have traditionally used document boxes that are designed to sit upright on

shelves, with file folders perpendicular to the shelves within boxes. This approach is satisfactory when records are in good condition, but it may also result in fragile and brittle papers standing on edge, forced to bear their own weight. This may be more stress than some papers can bear. Thus, uniform flat storage for archival records is recommended to alleviate this problem. Flat storage provides overall support for records and avoids problems of curling often associated with upright storage. The adoption of flat storage would necessitate a reorientation of upright boxes, the repositioning of box labels, and possibly the adjustment of shelves. Flat or clam-shell document boxes thus would be more suitable for this purpose than upright boxes, though the latter could certainly be adapted. While the shifting of an entire collection to flat storage might seem overwhelming, it should be considered. New shelving practices could be instituted slowly over time, with fragile or brittle items given priority for immediate shifting. At any rate, repositories should be aware of revised thinking in this area and take it into account, especially when renovating or planning new quarters. At a minimum, flat storage should be adopted where the physical condition of collections requires it.

Unbound Oversized Materials

Unbound oversized items often found in archival repositories include posters, blueprints, architectural drawings, broadsides, and maps. They should be placed in file folders that have an alkaline reserve and stored flat in map cases. All folders should be cut to the same size as the drawers to ensure that they do not get misplaced or pushed to the backs and crumpled. The size, weight of contents, and maneuverability of the folders must permit safe handling. In some instances, two people will be required to safely retrieve and file oversized folders (see Figure 6-2). The number of items per folder will depend on condition and value of material. At times, one item per folder will be warranted; however, since oversized materials are inherently awkward to handle and very susceptible to damage because of their size, the maximum number of items in a folder should be ten to twelve. Large pieces of paper cut to the same size as the folders may be used as interleaving sheets, both to protect fragile materials and to help bear the weight of items as they are being taken in and out of folders. Wide, heavy-weight paper that has an alkaline reserve can be purchased by the roll and cut to size for this purpose. If extra support is required to keep

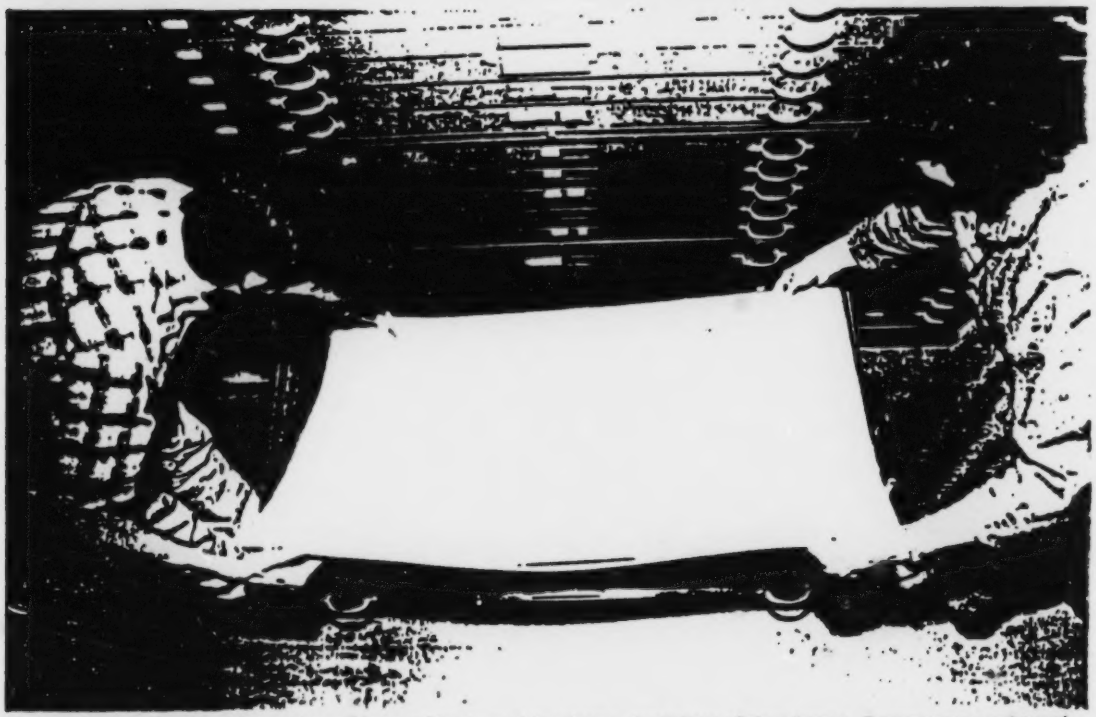

Figure 6-2. Oversized records are often endangered because of the sheer awkwardness of their format. Preservation is enhanced when two people handle them.

fragile items or materials with flaking images rigid and intact as they are being handled, a piece of alkaline mat board may be placed within a folder to keep items from flexing or bending. Especially large items may be folded once (with, rather than against, the grain of the paper) and stored in folders as well. If there is more than one fold, however, the points at which the folds intersect become very weak and will break down in time. If map cases are not available, oversized folders may be wrapped and placed flat on industrial shelving units. Depending on the sizes of the items to be stored, large, flat document cases are another alternative; these also may be placed on industrial shelves.

If items are too large for flat storage, an acceptable alternative is to roll materials around the outside of neutral pH tubes. Wide-diameter cardboard tubes may be used as well if they are first covered with either paper that has an alkaline reserve or polyester. The tubes provide rigid support for oversized items; under no circumstance should material be slipped inside a tube. Sheets of neutral pH tissue paper should be positioned on the items as they are rolled to serve an interleaving function. The rolled items should be wrapped in strong paper to protect the contents from light and dirt, and then labelled. Rolled items should be stored flat on industrial shelving or on top of a map cabinet, and not upright in bins or standing on the floor. Maintenance of proper environmental controls makes it possible to store oversized materials in a rolled state without having them become dried out and inflexible, and thus suffer damage as they are opened for use. Items that have been rolled for a long period and exhibit any resistance to opening should be humidified before any work on them is attempted (see Figure 6-3).

Vertical systems, which are often used for working files of blueprints and architectural drawings, are not suitable for archival storage. Vertical systems in which materials are stored in pockets or folders suspended from sliding rails often damage materials as they slide to the bottom of units and become crumpled. Pin and post systems, which employ self-adhesive hinges from which materials are suspended, are also damaging. Excessive strain is placed along the vulnerable top edges of oversized items, which must bear their own weight; the adhesive also may be damaging. Oversized items that have been encapsulated, however, may safely be stored vertically. A border of polyester is left to extend beyond the top edge of the capsule, and the unit is suspended from this edge using clips or pegs. Thus no strain is placed on the document. Static electricity keeps it from falling to the bottom of the capsule, and a strip of polyester folded around the bottom edge of the document keeps it from coming into contact with the double-coated tape. Oversized materials also may be encapsulated and then rolled. If either approach employing polyester is used, materials will still require protection from light.

Figure 6-3. These records were rolled without any interior support, and have thus suffered a great deal of damage as they were crushed, flattened, and bent. Humidification may be required before they can safely be opened for examination and treatment.

Bound Volumes

Bound materials commonly found in archival repositories include, but are not limited to, letterpress books, diaries, ledgers, journals, albums, and scrapbooks. Their storage requirements vary with size and condition. Small- and medium-sized volumes may be stored either upright on shelves or within folders and boxes if they are integrated with archival records. Volumes stored within folders and document boxes should be filed in such a way as to avoid physical distortion; spine down within folders is best for most volumes. Similarly sized volumes should be shelved together to ensure uniform support and thereby discourage warping of the boards or other physical distortions, which could result if large folios were interfiled with small volumes. Shelving bound materials with no regard to size considerations will result either in small books being damaged as they are jammed at the backs of shelves, or large volumes

suffering structural damage if they are shelved next to small volumes that cannot provide proper support. Volumes on shelves should be kept vertical and not allowed to lean or slant, which could result in warped structures. Bookends should not have sharp cutting edges and should be thick enough that volumes are not inadvertently jammed onto them and thus damaged. Volumes that have loose or missing boards (i.e., covers) or that are otherwise not intact may be handled in one of several ways. At a minimum, all broken or weak bindings should be tied, using unbleached cotton or linen tape. The flat tape should wrap around the four edges of the book without exerting excessive pressure;

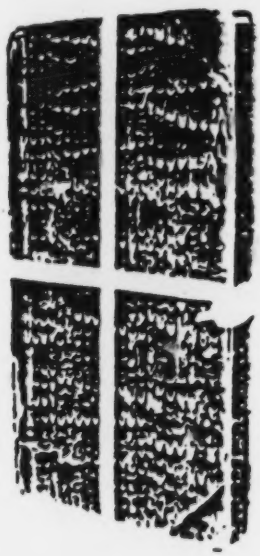

Figure 6-4. The linen tape will keep the boards on this weak volume intact until boxing or repair is possible.

the knot or bow should be positioned across the fore-edge of the book so as not to create an indentation on the cover or interfere with shelving practices (see Figure 6-4). Greater protection may be provided by wrapping weak volumes in strong wrapping paper or polyester book jackets, or by placing them in phased boxes. Phased boxes were developed at the Library of Congress to provide intermediate protection to materials waiting further treatment; they are easy to construct (see Appendix B11) or may be purchased in several standard sizes from archival suppliers. Solander, or drop-spine, boxes afford the greatest protection to bound volumes both during handling and in the event of a disaster. To function properly, they must be constructed to the precise dimensions of the volume and thus require skill to make. While expensive, solander boxes are warranted for highly valuable bound records (see Figure 6-5). Slipcases do not provide safe storage from a conservation standpoint. Volumes are abraded every time they are slipped in and out of the cases, and spines are left exposed and thus suffer from light damage (see Figure 6-6).

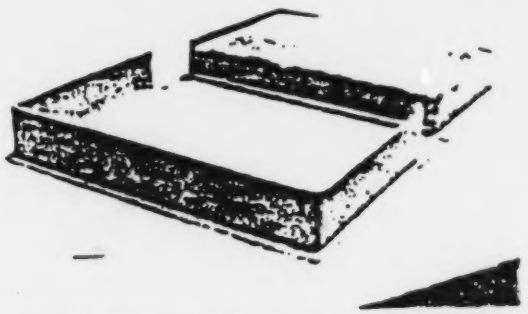

Figure 6-5. A drop-spine box provides physical support, protects valuable bindings from light and dirt, and allows easy, non-damaging access to the volume. Such boxes also afford great protection to their contents in the event of a disaster.

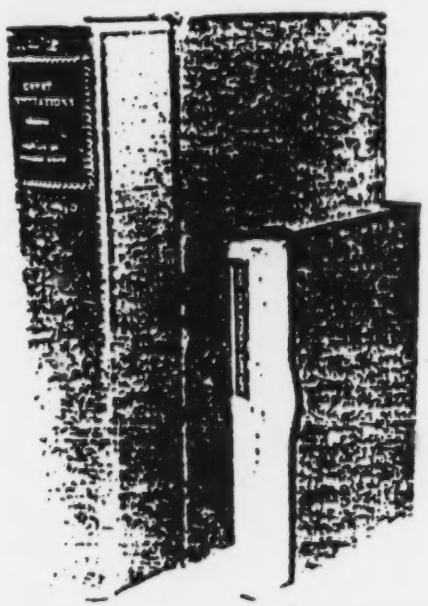

Figure 6-6. Volumes stored in slipcases suffer abrasion and faded spines. In addition, spines are often scratched in careless attempts to remove volumes from their slipcases.

In general, the bindings on large or oversized volumes are not strong enough to support their text blocks. They therefore require additional support and should be stored flat on shelves rather than upright. Ideally, shelves should be adjusted so that volumes are shelved in stacks no more than two or three high; the temptation to pull the bottom volume out from under a stack should be avoided. If flat storage for oversized volumes is impossible, they may be stored spine down on shelves. This will result in some abrasion of the spines but, given the structural weakness of large volumes, is less likely to result in books separating from their covers. An adequate sorting surface should be located near oversized shelving upon which volumes may be safely placed during retrieval and refiling. Scrapbooks and albums, which are sometimes oversized, also should be stored flat. They often contain loosely tipped-in items and enclosures that could fall out if the volumes were stored upright. As a further precaution, scrapbooks and albums should be wrapped or placed in large, flat document cases.

Photographic Materials

Every image (print and negative) should be stored in its own envelope or sleeve. These should be made either of paper or an inert plastic, such as polyester, polyethylene, polypropylene, or triacetate. There are advantages and disadvantages to either approach. Since paper is opaque, photographs will be protected from light, but they must be pulled in and out of paper sleeves for each viewing, thus possibly abrading the images. Paper envelopes with center seams should be avoided; envelopes with seams along one side are acceptable, but photographs should be inserted with the emulsion side away from the seam. Flap-type seamless paper envelopes are now available and are preferable to seamed enclosures.

Plastic envelopes and sleeves provide immediate visual access to the images without hands-on contact. They are more expensive than paper, however, and further disadvantages include the possibility of moisture buildup within the sleeves, which can result in ferreotyping (i.e., glazing, or the appearance of shiny patches on emulsion surfaces). Static electricity in plastic sleeves also can attract dirt and dust.

At this time, enclosures made either of an inert plastic or paper that has an alkaline reserve are recommended for the safe storage of photographic materials; the selection of one over the other will depend upon the resources of the repository and access requirements. There is evidence, however, that alkaline conditions accelerate the yellowing of albumen prints. (Albumen prints were produced in the U.S. from roughly 1850 to 1895. The paper was extremely thin and the prints were generally affixed to standard-sized mounts, such as carte-de-visite, cabinet, and stereo cards. They generally appear brownish in color, sometimes with a yellowish cast, and somewhat glossy.) For this reason, recommended storage enclosures for albumen prints are either neutral paper envelopes without carbonate buffering, or inert plastic sleeves.[9] As some photographic conservators are considering extending this storage recommendation to photographic materials other than albumen prints, archivists are advised to keep current with the photographic conservation literature.

Once enclosed in individual envelopes or sleeves, photographs should be placed flat on shelves in boxes that have an alkaline reserve. If vertical storage is used in filing cabinets, hanging folders are recommended to inhibit items from slumping in drawers and becoming crumpled or curled. Photographic materials are predisposed to curl because the emulsion layer rests on one side of the base; this imbalance or unequal pull on the base creates a tendency for the photograph to curl in toward the emulsion. Improper filing practices will exacerbate this tendency, resulting in damage to the emulsion layer.

Oversized photographs either should be stored flat, or, if absolutely necessary (as with panoramas), rolled as described in the preceding section. Although photographs generally should be removed from frames for storage, oversized photographs that are received in frames may pose less of a storage problem if they are retained in this format. If such practice is followed, however, framed items must be disassembled to remove harmful backings and mounts, and then reassembled with safe materials before placing the items in long-term storage. (See Figure 6-7.) Photographs that are affixed to brittle cardboard mounts are endangered if the mounting boards are chipping or breaking off dangerously close to the images. Such photographs should be given additional support by slipping a piece of slightly larger neutral pH board behind them in their enclosures, and then storing them flat. Cased photographs, such as daguerreotypes and tintypes (see Figure 6-8), may be protected by wrapping them in tissue paper and placing them flat in boxes; microfilm boxes are ideal for the smaller cased photographs. Glass negatives and lantern slides also need to be individually sleeved. If they do not have their own specially grooved storage containers, they should be stored on end in heavy-duty boxes that have an alkaline reserve; rigid supports (neutral pH board) should be placed between every five to ten glass plates to keep them upright. Glass negatives and lantern slides should never be stacked;

[9] James M. Reilly. "Albumen Prints: A Summary of New Research About Their Preservation." *Picturescope* 30:36 (Spring, 1982).

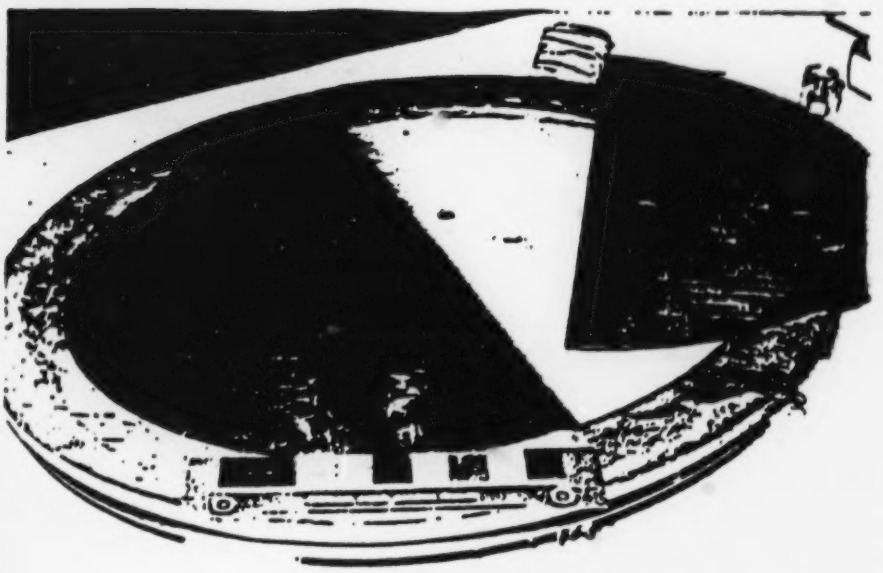

Figure 6-7. Acid will migrate from poor quality mounting and backing materials directly to the framed photograph. Staining, caused by the raw wooden backing, will eventually disfigure the front of the photographic print. Reproduced courtesy of the Newberry Library Conservation Laboratory Slide Collection.

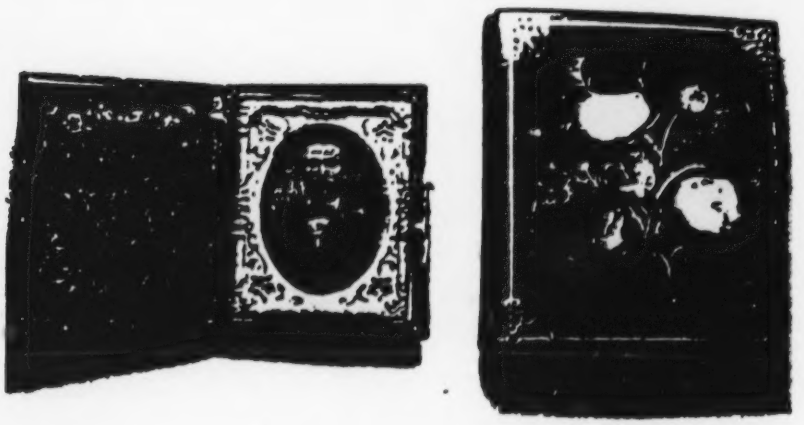

Figure 6-8. Cases that house daguerreotypes, ambrotypes, and tintypes are often fragile and may have broken hinges. Cased photographs should be wrapped individually and stored flat. Gloves should be worn when handling them, and no repair attempts should be made.

given their weight and fragility, the bottom images especially will be susceptible to breakage.

Microfilm

Use copies of microfilm may be stored within the temperature and humidity ranges specified for other archival materials. Master negatives, however, must be given separate storage in a strictly controlled environment free of gaseous pollutants. The temperature should not exceed 68° F, and the relative humidity should be maintained between 30 and 40 percent. To be considered archival, microfilm must meet precise standards of film quality, processing, and storage as outlined in the American National Standards Institute specifications (ANSI PH1.28-1976 and ANSI PH1.41-1976, or latest revisions thereof; see Appendix D for full citations).

Microfilm should be stored on noncorrosive metal or inert plastic reels, and placed in containers or boxes constructed of nonferrous metal, inert plastic, or board that has an alkaline reserve. Vertical storage in steel cabinets with a baked-enamel finish is recommended. Microfilm should not be wound too tightly on reels, and strips of alkaline paper with string ties should replace rubber bands as a means of keeping film from unrolling. Microfilm should be inspected (randomly, if the holdings are extensive) every two years. If there are signs of blemishes or deterioration, replacement copies should be made.

Sound Recordings

A primary concern in the preservation of sound recordings is keeping the dust level in the repository to a minimum. Dirt and dust can not only damage playback equipment, but, more importantly, it can distort the sound if it gets into disc grooves or miniscule pits in magnetic tape. As a further precaution against dust, sound recordings should be stored in cabinets with tight-fitting doors.

Disc recordings should be shelved fully vertical at all times. Because the disc shape is vulnerable to warping, discs should not be allowed to lean or slant, as this could result in distortion of their shape as well as sound. Rigid dividers separating shelves into compartments accommodating approximately twenty discs each should be used to maintain proper vertical storage. Because of their weight, shelves must be heavy-duty, and discs should never be stacked. Nor should they be allowed to extend out over the edges of shelves, because of possible breakage. Cellophane shrink-wrap, found on modern discs, responds to changes in environmental conditions and thus could cause discs to warp. It should be removed. Original paper or glassine inner linings on shellac and vinyl discs should be replaced with inert polyethylene or paper liners that have an alkaline reserve, which are available from archival suppliers. Acetate and nitrate discs should be stored in paper envelopes. Original packaging and jackets should be protected from light damage as many of these items are seen to have artistic and historic significance.

Repositories that maintain collections of older discs may have difficulty with playback if compatible equipment of the appropriate type and vintage is not available. Because of differences in stylus, construction, or record grooves, modern stereo equipment is often unable to accurately reproduce sounds from older recordings. A solution that alleviates the need to maintain a museum of phonograph equipment is to transfer the disc to a master reel-to-reel tape. The services of a professional sound laboratory that has access to the appropriate equipment should be sought. Such a reproduction would serve as a use copy to protect the original from excessive handling, and also would preserve an accurate representation of the recording as it was meant to be heard.

Magnetic (reel-to-reel and cassette) tapes should be stored away from stray magnetic fields—created by electrical motors or other sources of magnetic energy—as well as transformers or high voltage lines because of the possibility of sound alternation or accidental erasure. Some repositories prefer to store magnetic tapes on wooden rather than metal shelves, but in practical experience neither surface seems to affect sound quality. Problems with dust may be reduced by storing reel-to-reel and cassette tapes in small polyethylene bags within their original packaging. Vertical orientation on shelves is recommended.

Cassette tapes are not considered acceptable for long-term archival storage; if possible, they should be dubbed to 1.5 mil polyester reel-to-reel tape. If cassette recordings must be retained, C60 and C90 lengths are preferred to the longer lengths, which are more susceptible to breakage and significant print-through. Cassette cases with screw fittings only should be used as they can be opened safely in the event the tape tangles.

Magnetic tapes deteriorate from use because during playback they ride directly against the reading heads; after repeated use the sound can be noticeably degraded. Thus, it is advisable to make use copies of magnetic tapes and to retire the originals to storage. Research use of cassette and reel-to-reel tapes should be monitored, and use of the fast-forward speed on the playback equipment should be prohibited as it can distort the tape tension. The rewind speed also can cause tape tension to fluctuate. Thus, tapes should be stored in the played (or "tails out") position to ensure a steady tension throughout.

Videotapes

Videotapes are also susceptible to alteration through exposure to stray magnetic fields and thus have the same storage requirements as magnetic reel-to-reel and cassette tapes. At the present time, videotapes are largely a commercial phenomena that are undergoing rapid technological changes with relatively little concern for stability. While videotapes are being used increasingly to meet the short-term needs of the media and as a training vehicle for educational institutions and industry, contemporary videotapes do not meet archival standards for permanence. Since videotapes are increasingly finding their way into archival collections, however, preservation efforts must focus on handling and maintenance of this potentially unstable medium.

During playback, videotapes—like cassette and reel-to-reel tapes—ride against decoding heads and are thus somewhat degraded after each use. Use copies of valuable videotapes should be made, as well as duplicate first-generation copies from which additional use copies may be made as needed. An original tape should then only be used if another master reference copy is required. Playback machines must be cleaned regularly, and all research use monitored. Tapes should not be tightly wound, and fast-forward and fast-reverse, which can cause tapes to stretch somewhat, should be avoided. Videotapes should be stored in the played position and rewound only at the time of the next use.

7 Integrating Conservation and Archival Administration

Conservation must be seen as integral to every activity in an archival repository. Each time a collection item is used and handled, whether by archival staff in processing, patrons in conducting research, or preparators mounting an exhibition, there is a potential for damage or loss. Every function must be carried out from a conservation perspective. This conservation concern, or consciousness, can be developed, in part, by careful forethought—that is, thinking through all archival activities from a conservation standpoint and considering at each phase: What are the steps we will go through to accomplish this task? What are the potential dangers to the material? What staff members will be involved and what difficulties should they anticipate? Contingency plans should be developed for potential problems, and a clear chain of command should be identified to expedite decision making and cope with emergencies. As a result of this approach, often termed conservation management, collections will be less endangered and better cared for, and the repository will develop a reputation for being careful and conscientious with collections. The conservation aura created in a repository will be evident to virtually everyone having contact with the institution: staff, researchers, donors, professional colleagues, and the general public. Such a reputation can be only an asset in dealing with potential donors, in seeking financial support, or in negotiating cooperative programs with other institutions.

Conservation is basic to the very mission of an archival institution. It is inherent in the goal to collect historical material for research, exhibition, and similar cultural and educational purposes, and should be seen as closely aligned with, and integral to, such other concerns as security, collections maintenance and development, housekeeping, and reference services. Conservation responsibility crosses job lines and should be identified as part of every position description. Ideally, conservation will be mandated from the highest administrative level and work outward to encompass all staff activity. If such an ideal situation does not exist, however, development of a conservation approach to archival management can begin through the efforts of a single staff member having the interest and some training. An appropriate first step is the scrutiny of all archival functions from a conservation perspective to determine whether changes in policy or procedures are required that will enhance the useful life of collections. Persistence and politic agitation for change will be required to effect change and spread the conservation message.

At every stage of archival activity, the archivist must take responsibility for the care and protection of the collections. This advocacy role is a primary professional duty, which may at times be undertaken in seeming isolation. For example, other institutional priorities, or the weight of tradition, may mandate actions that pose threats to archival material, such as the continual exhibition of institutional treasures or the constant fetching and handling of unique items on behalf of board members or special guests. At an appropriate point, the archivist should begin to raise conservation and security issues that can be readily recognized as sensible and obvious. Implementing change in long-held institutional practices may be difficult, and persistence and patience will be necessary. Collection materials clearly need an advocate, and no one is better suited to the job than the archivist or curator. The archivist should serve as the intermediary between the safety and physical requirements of the material and all demands placed on it.

Depending upon the size of the archives staff, specific archival and conservation duties may be spread among a number of individuals or carried out by only one or two people. Staff size, however, should have no bearing on a conservation program that emphasizes proper storage and handling procedures for all material and takes a conservation approach to all archival functions. Much

collections as they are acquired (i.e., during the accessioning process), the conservation survey may be kept current. A checklist may be devised that can be filled out as the accession record is compiled. In this way, conservation problems are segregated intellectually, if not physically, making it easy to locate batches of related work when there is time to tend to it. The conservation checklist also can be used as a work sheet; as tasks are completed they can be initialed and dated by the staff member who did the work (see Figure 7-2).

Accessioning that is conducted down to the folder or item level will afford much information about the contents of a collection and its physical condition. Sound archival practice mandates such an approach in all but large and highly repetitive series. Conservation data that might be recorded during the accessioning process includes information on the location of highly unique formats and objects that would classify as art, as well as brittle or damaged material that is in immediate need of physical support or reinforcement. Treatments (such as silking, cellulose acetate lamination, or polyester encapsulation) that have already been carried out should be noted, as well as any evidence of treatment breakdown. The location of such items as newspaper clippings or similar highly acidic materials that can cause damage to adjacent items should be recorded. The location of photographs requiring special handling or enclosures should be listed, as well as the presence of glass plate negatives and similar fragile or fugitive images, such as cellulose nitrate and diacetate negatives or color prints. Physical problems that should be noted include evidence of tears, surface dirt and stains, tightly folded or rolled documents, framed items requiring disassembly, and bound volumes with boards detached.

A new level of evaluation and decision making is thus imposed upon the accessioning process. Staff must be trained to recognize various types of material and to make informed decisions regarding their physical condition and need for treatment. Security concerns may also come into play at this stage. Material that is valuable in monetary terms, has artistic merit, or has the potential to evoke strong emotional or acquisitive reactions should be separated from the collection to avoid the possibility of theft or defacement. Good copies may be kept in the collection for research use, and the original items may be filed in a separate secure location. In addition to identifying material that requires extra security precautions, material that is in very fragile condition and subject to damage or loss if exposed to any kind of handling should be closed to research use until the necessary treatment can be undertaken. In such cases, good reproductions can serve as working copies to meet the research needs of patrons and the requirements of staff as further processing of the collection continues. Preservation copying must be done with extreme care to avoid further damage to the material.

For reasons of both security and conservation, it is recommended that research access to collections be prohibited until the accession process is completed. It is unwise to make material available for research use until decisions have been made regarding its physical stability. Further, it is impossible to be sure that nothing is lost or missing following research use if no intellectual controls exist. Contents of a collection must be precisely known if they are to be protected.

Arrangement and Description

At this stage of processing, collections are analyzed at the item, folder, or series level for subject content and organization. Decisions are made regarding arrangement of the collection and information is recorded that will be used to create collection descriptions, inventories, and guides. Adherence to sound archival practice in these matters is essential. Appropriate systems of archival arrangement, precise descriptions, and sure knowledge of the location of collection items at all times are basic elements uniting two interlocking components of archival administration: conservation and security. These are constant themes that should undergird all archival activity.

A number of specific conservation concerns may be addressed as arrangement and description functions are carried out. The checklist created during the accessioning process will highlight specific problems needing attention. These are best addressed by the archivist as part of the overall decision-making process regarding retention of specific groups of material and collection organization. Within the context of these decisions, the material can be evaluated and conservation treatment priorities assigned based on the condition of the materials and their relative values. Decisions about archival arrangement and conservation treatment should be integrated at this point to ensure uniform approaches to collections management and efficient use of time spent on collections review.

While a collection is being organized, destructive fasteners, accretions, and other items viewed as foreign should be removed from the records. Foreign objects include paper clips, staples, rubber bands, string or cotton tape, ribbons, brads, locks of hair, or pressed flowers (see Figure 7-3). These items can convey much useful information about the collection. The manner in which a creator arranges records into particular groups will often give the archivist invaluable clues as to the importance and interrelationships of records. For example, fasteners used to unite groups of material can tell the archivist a great deal about how the creator of the

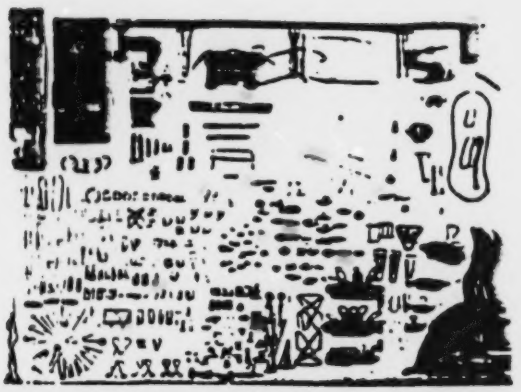

Figure 7-3. Collection of paper fasteners and devices assembled in the Manuscript Division, Preparation Section, Library of Congress. Photograph courtesy of the Library of Congress.

records viewed and ordered the world. It is thus important to leave these clues in place for the archivist to use in evaluating the collection and gaining intellectual control over it. Once the order and relationships among materials have been established, however, any object that can cause mechanical or chemical damage should be removed. Metal fasteners can rust, leaving permanent stains; they also can function as cutting edges against which paper will break as it is flexed over a period of time. Pressed flowers and similar organic materials can cause permanent staining through acid migration. Items that are damaging to surrounding material because of their acid content but are seen as integral to the collection may be either filed separately or kept within their file sequence but physically isolated to protect adjacent material. It may be appropriate to develop a separate filing and cross-reference system for bulky and potentially damaging items—pressed flowers, campaign buttons, locks of hair—that are deemed worthy of retention (see Figure 7-4). Highly acidic materials, such as newspaper clippings, should, at a minimum, be interleaved between two sheets of thin polyester (2-mil) or bond paper that has an alkaline reserve to inhibit acid migration. A small group of acidic materials also could be placed at the back of a folder behind protective sheets of polyester or alkaline paper. If there are large numbers of acidic items requiring interleaving, it may be useful to consider a quicker and less bulky solution, such as dividing the material into two folders (i.e., Folder 20 A—Correspondence; Folder 20 B—Clippings). Enclosures in bound records also must be removed if they are likely to cause chemical damage to adjacent pages through acid migration, or if their bulk will cause physical distortion of the binding.

Most often, archival materials are retained in original file folders until arrangement and description processes are underway, as the folders help to keep the records in their original order and also usually contain information that aids in identifying and dating the material. As final decisions are made regarding arrangement, however, original filing enclosures, which generally are of poor quality paper stock and highly acidic, should be discarded and replaced with file folders that have an alkaline reserve. Material requiring special protection, such as photographs, should be individually sleeved at this time also. Several common-sense factors should be considered as file folders and document boxes are filled. Folders and boxes should not be overstuffed, as this can result in much damage as brittle material is forced in and out of containers. The number of sheets that can safely be placed in a folder will depend upon the condition of the material and its value. There may be in-

Figure 7-4. Delegate badges and buttons retained in folders with textual records will cause physical stress and distortion in the latter.

stances when one item per folder is warranted, both for physical protection and reasons of security. If material is very brittle and has not been encapsulated, it is advisable to place a small number of sheets in a single folder to avoid excessive abrasion and possible breaking. In such cases, a simple precaution would be to interleave brittle documents between sheets of alkaline paper, allowing the interleaving sheets to bear the burden of handling as pages are turned. Folders should be scored to accommodate the thickness of material placed in them; when paper is in good condition—strong, flexible, and not discolored—fifty to seventy-five sheets may be safely placed in a folder.

Document boxes should be filled so that folders do not have excessive pressure placed on them; both overstuffing and underfilling are to be avoided. The attempt to place too many folders into a box will result in a great deal of damage to their brittle contents as folders are pushed and crammed into place. The impulse is to work a tight-fitting folder into its box using both hands, and brittle paper will just break into pieces under such stress. On the other hand, if a box that is to be shelved upright is only partially filled, the contents will take on a permanent curve or curl (see Figures 7-5, 7-6). This may be avoided by adding non-damaging material at the backs of the boxes to take up excess space. For example, museum board that has been laminated to the proper thickness may be placed behind the last folder to keep the contents upright. The problem of curling records will be avoided altogether, however, if boxes are stored flat on shelves.

Figure 7-5. Contents of underfilled boxes oriented to sit upright on shelves will take on a definite curve or bow in a short period of time, as seen in Figure 7-6.

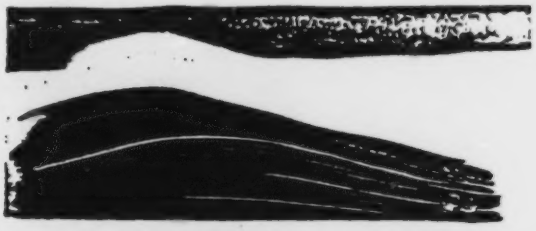

Figure 7-6. Such a configuration is especially damaging to photographs and brittle documents.

A supply of both 2½-inch and 5-inch document cases as well as flat storage boxes should be kept on hand to help reduce the problem of properly filling boxes. Very small collections, consisting of one or two folders, are probably best stored in a filing cabinet with appropriate dividers between collections.

A number of other basic conservation procedures may be incorporated into arrangement and description functions. Such techniques as humidification, surface cleaning, mending, and polyester encapsulation may be easily learned by the archivist through basic training and practice, and carried out as other archival functions are implemented. Technicians or other personnel also can be trained to do such tasks, which can be quite time-consuming depending upon the size and condition of the collection.

In archival settings, such treatments as surface cleaning and mending are carried out to stabilize the material, protect it from further damage, and ready it for safe use by researchers. Except in rare instances of highly valuable items that are important as artifacts or artistic works, archival conservation treatments are not carried out to improve the cosmetic appearance of material. Rather, surface cleaning is undertaken to remove gritty dirt or soot, which can obscure or abrade images or text and can cause further damage by becoming imbedded in the paper fibers. Mending is done to repair past damage and stop the tears from becoming worse. Humidification of tightly rolled or folded materials, such as documents, blueprints, drawings, and photographs, allows them to be safely opened and evaluated for archival significance and further treatment requirements. The goal is the continued availability of the records; improvements in physical appearance, while pleasing, are of secondary importance.

The recommended steps that will help to integrate conservation measures into archival processing call for the compilation of an initial conservation worksheet during accessioning procedures. This provides an interim record on the physical condition of the collection,

9 Conservation Survey

The development of a sound archival conservation program must be based on a thorough understanding of the physical plant and environment, the range and formats of collection materials, and archival procedures and policies. A number of elements that are seen as routine archival tasks, and therefore far removed from the mystique of conservation, do indeed play a vital role in the overall development of a conservation program and in the ultimate preservation of archival materials. Once data is gathered regarding the scope and character of holdings, storage capabilities, and processing procedures, it is possible to compare present conditions against developing standards of archival conservation. As a result of such self-study and evaluation, a needs assessment statement can be developed which may be used to design a phased preservation program.

Self-Study Questionnaire

The following questions have been designed as a brief guide to consideration of a manuscript or archival repository from a conservation perspective. The questions focus on types of material, policies and procedures, and the physical environment. They will also serve as an aid in turning a critical eye to current archival and conservation practices. While there are no right or wrong answers in such a data-gathering exercise, the questions are certainly leading in that they highlight areas of conservation concern.

1. Types of material held by repository:
   - ____handwritten documents and records on paper:
     - ____single sheets ____bound format
   - ____typewritten material (correspondence, reports, etc.):
     - ____with handwritten notations
   - ____all-print material
   - ____copy methods represented: ____letterpress ____caroon ____mimeograph ____thermofax ____other
   - ____bound volumes:
     - ____diaries and journals ____ledgers and account books ____scrapbooks
   - ____newspapers
   - ____photographic prints (black and white) on paper
   - ____photographic prints (color) on paper
   - ____cased photographs: ____daguerreotypes ____ambrotypes ____tintypes (ferrotypes)
   - ____ photographic negatives on film:
     - ____ cellulose nitrate
     - ____ safety film (diacetate)
     - ____ safety film (triacetate and polyester)
   - ____ glass plate negatives ____ lantern slides
   - ____ motion-picture film:
     - ____ cellulose nitrate film
     - ____ safety film
   - ____sound recordings: ____cylinder (Edison) ____disc ____cassette tapes ____reel-to-reel tapes
   - ____videotapes
   - ____computer tapes
   - ____records in microformats: ____microfilm ____microfiche
   - ____works of art on paper: ____framed under glass
   - ____architectural drawings: ____renderings ____tracings
   - ____blueprints and similarly processed reproductions
   - ____maps and charts
   - ____posters and advertising broadsides
   - ____three-dimensional objects
2. Dates of holdings:
   - ____pre-1850 ____%
   - ____1850–1900 ____%
   - ____post-1900 ____%
3. Size of holdings:
   - ____items ____linear feet
4. Where are the records stored? ____separate stack area ____open shelves ____departmental office ____warehouse ____basement ____attic ____closets/cupboards ____other
5. How are the records stored?: ____boxed on shelves ____boxed on the floor ____filing cabinets ____map cases ____other
6. Are the shelves or storage units: ____wooden ____metal
   Type of finish: ____polyurethane varnish ____baked enamel ____paint ____other

7. What types of storage containers are used?
   ___alkaline boxes ___transfer cases ___miscellaneous cartons ___alkaline file folders ___manila folders ___tubes ___other
8. Is the storage area/reading room:
   ___air-conditioned
   ___temperature- and humidity-controlled: temperature maintained between ___degrees F and ___degrees F, with relative humidity between ___% and ___%.
   ___outfitted with air filtration device(s)
   ___surrounded by or near steam or water pipes
   ___susceptible to leaks or flooding
   ___outfitted with water detection system
   ___outfitted with smoke/fire detection system
   ___outfitted with fire suppression system: ___ sprinkler system ___gas system (Halon type, etc.)
   ___equipped with fire extinguishers
   ___subject to insect or rodent infestation
   Are the monitoring and detection systems operational? Are these systems inspected periodically? Are staff members trained to use fire extinguishers?
9. Is the storage area/reading room illuminated with:
   ___incandescent light ___fluorescent light ___direct sunlight ___quartz light
   Are protective shades or ultraviolet filtering devices used?
10. Who has access by key to locked storage or vault areas:
    ___entire archives staff ___designated archives staff ___volunteer or student employees ___other institutional staff ___maintenance staff ___engineers ___security personnel ___other
    Is there an intrusion alarm system? Is the system operational?
11. Does the repository have a written disaster plan? Is this institution-wide, or does it apply only to the manuscripts/archives division? What natural disasters are likely in the local geographic area?
12. Are researchers monitored at all times? Are reading room rules posted and enforced? Is there a written policy covering abuse or possible theft of material?
13. Is the archives staff trained in:
    ___proper ways to handle manuscript and archival material
    ___basic conservation procedures
    ___emergency procedures
14. Is there anyone on staff with designated conservation responsibility or conservation expertise?
15. Are funds allocated for conservation purposes? Amount per year: ___; ___% of total budget.
16. Is there an in-house conservation laboratory facility? Are treatments carried out by trained personnel? Which of the following are undertaken:
    ___surface cleaning ___washing ___removal of pressure-sensitive tape and other intrusions ___deacidification ___mending ___reinforcement ___encapsulation ___lamination ___leather treatment ___treatment of three-dimensional objects ___other
17. How many staff hours per week are spent on conservation activities?
18. Does the repository contract for outside treatment services? How have these services been evaluated?
19. Are preservation/security copies of valuable records and photographic prints and negatives made for research use?
20. Has a preservation microfilming program been instituted?
21. Are original materials (manuscripts, photographs, posters, etc.) placed on exhibition? What conservation and security measures are taken?
22. Has a condition survey of the repository's holdings ever been undertaken?
23. Have conservation treatment priorities been established and, if so, on what basis?
24. Characterize the overall conservation needs of the institution:

Condition Survey

Following a review of repository-wide conditions and policies, attention should be directed to the needs of individual collections or items for protection and support. A condition survey is the best means of gathering data needed to evaluate treatment priorities. A simple conservation checklist may be devised for recording infor-

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INTRODUCTION

Care of an archival collection must be an ongoing part of daily activities. If the collection is in good order, staff will be more likely to reshelve items carefully and try harder to keep storage and work areas clean and tidy. To encourage staff members in these activities, assign them the responsibility for shelf conditions in various areas, and make them responsible for the appearance and order of their section.

Don't assume that only the older materials require special care and handling. All items in an archival collection are held for potential future use, and each one should be stored and handled as carefully as possible.

HANDLING

Each time you handle archival material carefully and correctly, you are practicing "hands-on conservation" in its most basic sense. Every archives can promote good handling techniques — among users as well as staff — as a means of keeping the collection in good condition.

The following practices should apply whenever materials must be handled:

- Handle as little as possible.
- Always have clean hands, and preferably, wear lint-free cotton or nylon gloves. Do not apply hand lotion or cream immediately before handling archival material.
- Use both hands or a temporary support when holding and carrying items, especially if they are fragile.
- Before moving a large object, plan ahead. Clear the route, open doors and remove obstructions. Make sure that there is space available to put the item down at your destination.
- Don't try to carry too much at once. Use a trolley or book truck to move a large number of objects, or make several trips.
- Have two people handle oversized material.

In the storage areas:

- House all archival material, with the exception of books in good condition, in some form of archival-quality protective enclosure. (See Protective Enclosures, p. 31, and Paper, p. 58-9.)

- Choose a box of an appropriate size for the material that is to be stored in it. The contents should fit in the box firmly enough to prevent sagging and distortions, but loosely enough to be easily removed and replaced. A partially empty box should be "filled" with loosely wadded acid-free tissue paper or with blocks of mat board or acid-free cardboard so that materials are held upright.

- Whenever you find an acidic slip, envelope or other enclosure made from acidic components, discard it to prevent contamination of other material. If it is intrinsic to the archival item from which it was removed, place it in a separate, well-labelled enclosure and store it with the item.

- Provide adequate shelf space for each box or object. Resist the temptation to try to force just one more box onto a shelf.

- Use a step ladder to reach collections on upper shelves. Pulling anything off a high shelf from ground level creates the risk of damaging material or injuring a staff member.

- Isolate new accessions on arrival until they have been examined and their problems, if any, have been dealt with. Never put mouldy or infested materials in with the main collection (see Pests and Mould, p. 48).

For materials in use:

- Always remove an object from its protective enclosure by pulling on the enclosure, not on the object.

- When making photocopies, do not press archival materials down too hard on the copier plate.

- Never use pens near archival material. Always use pencil, which can be erased if a document is inadvertently marked.

- Promptly reshelve materials that have been in use.

- Do not circulate or lend deteriorated material. Have copies made for these purposes. If damaged documents or photographs must be used before they can be repaired, encapsulate them to reduce the risk of further deterioration.

- Check all material when researchers return it after use. By this survey, you not only review its condition but you indicate to researchers that you are monitoring their use of the material.

- Treat minor problems immediately, before returning items to the general collection. Flatten folded corners, place books with loose spines or covers in boxes, provide a support for photos and drawings with brittle backing boards, and so on.

- Polyester film (mylar) envelopes and encapsulation are the safest forms of protective enclosure for flat items. If budget and space limitations make it impossible to provide them in the quantity your collection requires, keep a selection of mylar sleeves of various sizes on hand in the reading room. The sleeves will serve as temporary protective enclosures for items currently being used by a researcher.

Tapes, adhesives and other fasteners require special mention because, although they may seem innocuous, they can cause enormous damage to objects in the collection.

- Never use pressure-sensitive tape on original material. Tape adhesives discolour over time and can stain a document permanently. They may even bleed through to adjoining documents. The restriction on pressure-sensitive tape applies to transparent tape, masking tape, adhesive book tape and (despite manufacturers' claims) "archival quality" adhesive tape. Some brands of "archival" tape are better than others, but until long-term testing has shown conclusive results, it is advisable to avoid them all.

- Remove elastic bands and book bands made of acidic paper, paper clips, staples and pins whenever you see them in contact with archival materials. All of these fasteners cause staining and discoloration. Some may become permanently affixed to the document over time. Others can cause indentations and cockling.

- When archival items should be held together, use only plastic, plastic-coated, anodized aluminum or stainless steel paper clips. A slip of acid-free paper should be placed between the clip and the archival document to prevent marking of the document.

- For materials which have already been repaired with pressure-sensitive tape or are stuck together from some other cause, see the recommendations on p. 37.

RULES FOR USERS

Draw up a list of rules for users and make them a condition for use of the archives. Staff should also understand the preservation principles behind the rules in order to administer them effectively. The rules suggested below may be reproduced on a hand-out to be shown to each user.

1. Eating, drinking and smoking are not permitted in the reading room.

2. Coats and umbrellas should be left at the coat rack and umbrella stand provided.

3. Use a pencil for taking notes rather than pens or markers. [Consider supplying patrons with pencils as a way to ensure that this requirement can be met.]

4. Handle archival material carefully. Never write on it or use it as a backing pad while writing.

5. Do not force bound (book) material open. Support book covers from beneath to avoid strain on the hinges.

6. Archival material must not be marked, cut, torn, folded, soiled or in any way damaged. Any accidents, or the discovery that material is damaged or not in order, should be reported at once to the staff.

7. To prevent unnecessary exposure to light, keep material covered or in its protective box or folder when not in use.

8. Keep all material in order within the proper box or folder.

9. Never remove material from protective mylar sleeves or envelopes without permission.

10. Photocopying of documents will be done by the staff.

11. Archival material may not be removed from the reading room for any reason. Users should be prepared to present bags and briefcases for inspection when leaving the reading room. [Alternatively, the policy may be that bags and briefcases must be left with the security guard or archivist.]

HOUSEKEEPING

Basic housekeeping is an unglamorous but essential part of archival work. A clean, neat, well-organized storage area helps to prevent accidents, and reduces deterioration of the collection from soiling and physical damage. It also encourages staff and users to respect the collections.

Arrange for regular inspection of the collections, monthly at least or weekly if possible. As you make the rounds, watch for indications of improper care, and be on the look-out for signs of trouble, e.g., water leaks, the presence of insects or other pests. Pest control is an important part of housekeeping. If you discover infested or mouldy material, segregate it. (See Problem Materials, p. 36, and Pests and Mould, p. 48.)

Eating, drinking and smoking should never be permitted near collections. Restrict these activities to designated areas elsewhere in the building. The presence of food crumbs or drink spills encourages insects and causes staining of archival material, while smoking produces pollutants and increases the risk of fire.

Organize a regular cleaning program to ensure that storage areas, work room surfaces and reading room tables are clean and dust-free. The cleaning routine should include sweeping, dusting and vacuuming. Remember to include not only the floors, shelves and work surfaces, but the tops of cases or cabinets, pipes, air supply and return grills, and light fixtures. Always vacuum books and storage boxes with a cheesecloth filter over a soft brush attachment.

Before reshelving material that has been in use, dust storage boxes and their shelves. To avoid spreading dust around, use a damp cloth or a duster treated with Endust. (Endust is not suitable for use directly on archival material.) Feather dusters are not advisable, as they tend simply to circulate dust in the air.

THE STORAGE AREA

A well-designed archival storage area will have sufficient unused space to allow for expansion of the collection. Try to foresee storage needs for at least the next five years.

The layout of the storage area should serve the needs of both collections and staff:

- Make the aisles between stacks wide enough that people can pass without bumping into or brushing against shelved material.
- Raise the lowest level of shelving 4"-6" above the floor.
- Set shelves and cabinets away from outside walls, and position them in a way that allows air to circulate around them.
- Do not situate shelves near water pipes, heating pipes or any other source of heat.
- Position light fixtures over aisles rather than over the shelving for efficient use of lighting.
- Have several large flat surfaces available throughout or near the storage area for the examination of books or the contents of storage boxes.

Nothing should be stored on the floor, where water, caretakers and pests could cause damage. Have a supply of 2" x 4"s on hand so that if large amounts of material must be set on the floor temporarily, the lengths of wood can be placed on their sides to create a platform.

If the outside walls of the building form part of the storeroom walls, keeping the storage units away from those walls is an important precaution. The walls may be damp, especially when the temperature outside is lower than inside and the building is poorly insulated. It is best, in fact, if the storage area can be located in the interior of the building where environmental conditions are normally easier to stabilize. In the interests of pest control, the storage area should also be located well away from the building's garbage depot, and from kitchen facilities or eating areas.

STORAGE SYSTEMS

In most archives, storage systems consist largely of shelving. Shelf units should be strong and made of a substance that does not react adversely with the collections stored on them.

Steel shelves or cabinets with a baked enamel finish are the best choice. If this type of unit is beyond your archives' budget, use wooden or plywood shelves coated with a sealant and lined with mylar, so that acids from the wood are less likely to contaminate the collections. Until recently, polyurethane varnish and epoxy paints were recommended as sealants, but it has been discovered that they release potentially harmful gases even when fully cured. Acrylic latex paint is now preferred for sealing wood surfaces. This paint

has a curing time of two weeks, after which collections can be installed. If wooden shelves cannot be painted, a shelf lining of polyester, acid-free paper or acid-free board will reduce the migration of acids given off by the wood.

Shelves — whether metal or wood — should have no sharp edges or corners, and their surfaces should be smooth and non-abrasive. Shelving units for archival storage must be solidly braced if freestanding; otherwise, they should be secured to a wall, or to the ceiling if the nearest wall is an outside one. A top cover on the shelves is advisable in order to reduce the amount of dust settling on materials and lessen water damage from a roof leak, burst pipes or an activated sprinkler system. Waterproof sheets may also be used as side covers: the sheets should hang loosely to permit airflow, or may be rolled up by day and down by night.

Storage systems must be tailored to the various types of material in the collection. While open shelving can usually accommodate document and book storage, certain other materials (e.g., photographs, microfilm, framed art, flat maps) require specialized systems such as drawers or cabinets. These requirements are described for each material in Chapter V.

Inevitably, occasions will arise when not enough shelf space has been allocated for all the materials in a particular collection. Staff should not, even as a temporary measure:

- force an object into a tight space on a shelf
- stack objects or storage boxes
- lean items against walls, put them up on top of a shelving unit, or leave them on the floor.

The shelving process is an important part of storage. Accept the need to shift a section occasionally. If an object does not fit easily on a shelf, make space by rearranging the shelf or unit. These periodic reorganizations are time well spent, for they forestall future trouble and expense over items that have become damaged or prematurely aged through improper storage.

Be sure to plan for oversized and oddsized items. Such materials are found in every collection, but there is a tendency not to make allowances for housing them. Existing standard-sized shelves can be extended with painted plywood overlays. In a new storage area, it is a good idea to plan ahead by purchasing or building sufficient oversized shelves to supplement the standard shelving.

It should be easy to get materials in and out of boxes and drawers. Allow enough free space in these containers that materials can be handled without difficulty, but not so much space that the contents may sustain damage from shifting when the container is moved. (For more information on packing storage boxes, see Handling, p. 25.)

Do not fold archival materials or force them to fit into boxes in order to make them conform to the storage system. Instead, make the system accommodate a range of objects.

10. Do not give permission for an object to be put in an enclosure (e.g., mat, frame or encapsulation) or removed from one, unless the task will be done to your specifications by a competent person. Always specify proper archival methods and materials.

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Preservation Packet

Care, Handling and Storage of Photographs

International Federation of Library Associations and Institutions

CARE, HANDLING, AND STORAGE OF PHOTOGRAPHS

International Federation of Library Associations and Institutions Core Programme on Preservation and Conservation

Introduction

Photographic materials have complex physical and chemical structures that present special preservation challenges to the librarian and archivist. Since the birth of photography in the late 1830s, many different photographic processes and materials have been utilized, each subject to deterioration through time and with use. Although deterioration is an ongoing natural process, nevertheless much can be done to slow the rate at which it takes place in photographic images.

Deteriorated photographs of extreme artifactual value may require specialized conservation treatment by a professional photograph conservator, often a costly, skill-demanding, and time-consuming procedure. For the majority of photographs in research collections, single-item conservation of deteriorated photographs is probably not a feasible or a cost-effective preservation solution. Instead, promoting proper care, handling, and storage through staff and user education will have a more lasting, positive impact on the preservation of a collection.

This publication is intended to provide a basic understanding of how and why photographs deteriorate and what can be done to slow this process. The information below focuses on the photographic formats most commonly found in research libraries and archives, namely black-and-white silver gelatin prints, glass plate and film base negatives, and color transparencies.

Structure of Photographs

Photographs are composite objects. A typical photograph consists of three different parts:

1) **Support** — The support layer may be glass, plastic film, paper, or resin-coated paper;

2) **Binder** — The emulsion or binder layer, most commonly gelatin, but also albumen or collodion, holds the final image material or image-forming substance to the support; and

3) **Final image material** — The final image material, made of silver, color dyes, or pigment particles, is usually suspended in the emulsion or binder layer.

Many different final image materials and binders have been used over the years. Today, however, almost all black-and-white photographs are composed of silver suspended in gelatin.

Identification

Identification of various types of photographs requires a basic knowledge of the history of photographic processes. Curators and archivists charged with responsibility for photographic collections must be at least somewhat familiar with the various photographic processes and know when they were used. This information is needed not only for cataloging but also for making informed preservation decisions. Processes must be identified in order to distinguish between later copies and vintage originals. In addition, storage needs differ with types of photographic materials. Photographs made by processes that may offgas and damage other materials must be stored separately. The ability to identify photographic processes is also a prerequisite for selecting appropriate storage enclosures for photographs. For example, acetate and nitrate film negatives should be stored in individual buffered paper sleeves because plastic enclosures trap harmful offgassing from the film base which further accelerates deterioration of the image and film. Many excellent books devoted to historic photographic processes are available.

Some Common Photographic Processes, When They Were Introduced, and When They Were Most Popular

1839-c1860	Daguerreotypes
1839-c1860	Salted paper prints
1851-1890	Glass plate negatives (general)
1851-1885	Collodion wet plate glass negatives
1880-1920	Gelatin dry plate glass negatives
1889-1951	Nitrate negatives (introduced by Kodak; ceased production in 1951; dates of production outside the United States vary)
1850-c1900	Albumen prints
1885-1905	Gelatin and collodion printed-out photographic prints
1880,1900-	Black-and-white gelatin developed-out photographic prints
1934-	Acetate negatives introduced for sheet film
1935-	Chromogenic color film and transparencies (introduced by Kodak; Kodachrome was the first process)
1948-	Instant black-and-white process (introduced by Polaroid; sepia first, then black-and-white in 1950)
1960-	Polyester film introduced
1963-	Instant color print process (introduced by Polaroid; Polacolor was the first process; SX 70 was introduced in 1972 and Polacolor 2 in 1975)

Collection Management

Collection management includes four basic components: inventory, appraisal, cataloging, and proper housing and storage. Inventory is needed to determine which photographic processes are represented in the collection and which prints are mounted, unmounted, or in albums. Appraisal of the collection entails evaluation based on value, appropriateness of the collection to the mission of the institution, and an assessment of housing and preservation needs. Cataloging and arrangement involves identifying each item, dating it, and assigning an accession number.

Materials in the collection, as well as all incoming materials, should be screened systematically during the inventory and appraisal steps in order to identify items with special preservation problems that require conservation treatment or stabilization until treatment can be obtained. Such actions may include protective boxing or stiff card supports underneath brittle or broken photographs. The main problems to look for are: (a) inherent problems affecting the structure of the print, such as extreme fragility, flaking binder layers, or other physical damage; and (b) external problems, such as active mold, insect infestation, or the use of inappropriate pressure-sensitive tape or rubber cement adhesives.

Catalog records should be prepared for each item in the collection that state the nature of the object, its physical description, and an evaluation of its condition. Where large numbers of similar materials are concerned, a finding list containing general or characteristic information may suffice in lieu of individual item records. Cataloging and access tools can support preservation by minimizing the need for researchers to handle original photographs or one-of-a-kind images, including negatives for which no reference copy exists. If good cataloging and finding aids are provided, the need for researchers to browse through originals is reduced. Some examples of finding aids that promote access to images (but not to originals) are: (a) a small 35mm photo duplicate contact print of the original attached to a catalog card; (b) photographic images stored on videodisk; (c) photographs reproduced on microfilm or microfiche; and (d) photocopies of originals.

Once the collection has been inventoried, appraised, cataloged, and arranged to library and archives standards, each photographic medium — prints, film base and glass plate negatives, and slides — should be housed and stored separately if possible. Items that are too deteriorated to be handled without damage should be duplicated. A photocopy can be made from the duplicate for

research purposes. Once a deteriorated original is duplicated it may be withdrawn from service to researchers.

Comprehensive collection management includes proper maintenance of and storage for the collection. Protective housings (to be discussed later) can minimize handling damage and wear and tear. A proper storage environment is the best defense against deterioration, since photographic processes are affected by harmful chemical gases, high temperature, and improper relative humidity levels.

Deterioration

Four principal factors contribute to photographic deterioration: poor environmental storage conditions, the presence of residual photographic processing chemicals or the use of exhausted processing chemicals, poor storage enclosures and shelving conditions, and rough or inappropriate handling that results in unnecessary wear and tear.

Environmental Factors

The environmental factors that affect the preservation of photographic materials are relative humidity and temperature, air pollution, light, and housekeeping practices.

Relative Humidity and Temperature

All photographic materials are sensitive to high, low, and fluctuating relative humidity (RH), which is a measure of how saturated the air is with moisture. High RH affects all components of photographs. High RH causes a gelatin binder to become soft and sticky, making it vulnerable to mechanical damage and image deterioration. Low RH causes the binder to shrink and crack and the secondary support to curl.

High temperature speeds up the rate of deterioration. The higher the temperature, the faster a photograph deteriorates, especially at high RH levels. High humidity and temperature, combined with the damaging effects of air pollution, are especially damaging and cause silver images to oxidize and color dyes to shift and fade.

High temperature and high humidity conditions may contribute to the growth of microscopic mold spores on the image-containing layer and on primary and secondary paper supports. Once active mold infests photographic materials it is usually impossible to remove without damaging the photograph. Mold tends to develop when the temperature is above 75-80° F and the RH is greater than 60%.

Temperature and RH fluctuations, or "cycling", result in chemical and mechanical changes that are especially damaging to photographs. Cycling promotes the movement of moisture in and out of a photograph, speeds up the rate of chemical deterioration of primary and secondary supports, and promotes the breakdown of the binder that holds the final image material to the support. When both humidity and temperature are high, or when materials undergo temperature and RH cycling, structural damage and the rate of chemical deterioration are greatest.

The ideal RH for storage of a mixed collection containing historical photographic prints, slides, and negatives is between 30% and 50% without cycling more than 5% a day. If only photographs are stored in a given area, 30-40% RH is best. If photographs are stored with paper, parchment, or leather materials, it may be necessary to maintain 40-50% RH to avoid placing unwanted stress on non-photographic materials. However, some materials, such as negative films and transparency films (nitrate and acetate plastic) and some historic glass plate negatives, will deteriorate further at 40-50% RH. The deterioration of acetate and nitrate is strongly dependent on RH even at moderate levels of 40-50%. Recent American National Standards Institute (ANSI) specifications recommend 20-30% RH for long-term storage of "safety" film (acetate and polyester base) to assure maximum life expectancy. Recent research (Reilly, 1991) indicates that historic nitrate film also benefits from these same storage conditions. Glass plate negatives should be stored at 30-35% RH to minimize glass decomposition and flaking (McCabe, 1991).

Storage temperatures should be kept as low as possible but high enough to allow reasonably comfortable working conditions for staff. The highest recommended storage temperature for black-and-white negatives and prints is between 65° and 70° F. Daily fluctuations greater than 5° should be avoided. Color materials, which fade more in elevated temperatures, should be kept in cool storage whenever possible (a set point within the range of 40-65° is best), or in cold storage (25-40° F) whenever feasible. Generally, the colder the storage the better. When choosing a system, keep in mind that cold storage units are expensive to maintain, especially units for lower temperatures. Refrigerators may present low cost options for small, valuable collections of color materials (Wilhelm, 1990). Caution must be exercised if using

cold storage systems to avoid elevated RH or water condensation on valuable original photographs. All cool or cold storage systems limit access to the collections because the photographs must equilibrate to ambient temperature and RH before they are used in order to avoid moisture condensation.

Air Pollution

Air pollution attacks photographs in the form of: (1) oxidant gases, (2) particulate matter, (3) acidic and sulfiding gases, and (4) environmental fumes. Oxidant gases are composed primarily of pollution created by burning fossil fuels such as coal and oil. Nitrogen oxides (oxide and dioxide) and ozone are the two main gases that threaten photographic images. Nitrogen oxides are produced by combustion, as in automobile engines. Ozone occurs naturally in the upper atmosphere, but can be formed in the lower atmosphere when sunlight interacts with nitrogen oxide. Ozone is also produced by some electrostatic copiers. Oxidant gases cause photographic images to fade by chemically interacting with the silver image material.

Particulate matter, such as soot and ash particles from manufacturing processes, exists in abundance outdoors and can enter the library or archives through heating and cooling ducts, doors, and windows. Particulates, which may be greasy, abrasive, and chemically or biologically active, settle on shelves and on collection materials and create dust that is spread to other materials when they are handled.

The by-products of combustion combined with moisture in the atmosphere pose another risk to photographic materials. When fossil fuels such as coal and oil are burned, nitrogen and sulfur dioxide are produced. The reaction of nitrogen and sulfur dioxide with water in the atmosphere produces nitric and sulfuric acid. These acids attack all components of photographs and cause silver images to fade and paper and board supports to become brittle.

Environmental fumes can be especially damaging to photographic images even in small quantities. Peroxides from untreated wood, paints, and varnishes; poor quality paper or plastic products in close proximity to photos; and the fumes from common cleaning solvents can cause images to oxidize and fade.

Air entering the storage area should be filtered and purified to remove gaseous and particulate matter. A well-designed filtration system includes cellulose or fiberglass filters that remove particulate matter, and a charcoal absorption system that filters out gaseous pollutants. Air filters must be changed regularly to be effective. Air circulation should also be checked periodically. There should be no stagnant air pockets, or drafts that bring unfiltered outside air into storage areas. Storage cabinets, enclosures, and boxes may provide some protection from gases. Many photocopiers emit ozone, which is damaging to photographs, so their use near collection storage areas should be avoided. Do not permit unsupervised cleaning or painting of storage areas. Do not allow unknown cleaning materials or those containing chlorine and other bleaches, oil-based paints, or varnishes to be stored or used near photographic materials. Avoid storing photographs in freshly painted rooms since paint vapors can interact with the silver image material causing it to fade. Use only mild solvents such as soaps and water-based latex paints in a well-ventilated area to clean and paint photographic storage areas. Ideally, latex-painted display cases or storage areas should be allowed to dry for at least a week before use with photographs.

Light

Well-processed black-and-white silver gelatin prints and negatives are essentially stable to moderate amounts of light. Primary and secondary supports can be seriously damaged, however, when exposed for extended periods to visible light in the 400- to 500-nanometer range, and to ultraviolet (UV) light in the 300- to 400-nanometer (near ultraviolet) region. Damage caused by light is cumulative and depends on the intensity and length of exposure. Sunlight and standard fluorescent light are both strong sources of UV. Color slides are particularly susceptible to fading when exposed to both visible and UV light. For example, Kodachrome slides can fade significantly within 10 minutes of projection, although Kodachrome has excellent color stability in dark storage.

Historic photographs and color photographs should be kept at lower light levels than modern black-and-white photographs. Light levels in exhibits should be kept as low as possible, but high enough to allow patron viewing. Levels for historic and color photographs should be in the range of 3-10 footcandles (30-100 LUX). Although some modern photographs can be exhibited under much brighter conditions (up to 20 footcandles), it is best not to exceed 10 footcandles whenever possible. Ultraviolet light levels should not exceed 75 microwatts per lumen. A UV meter is required to measure ultraviolet light levels; incandescent light levels can be measured with a photometer or even a camera light meter (Canadian Conservation Institute, ***Notes***).

Reading room lights should be kept at a comfortable viewing level. Windows and fluorescent lights in reading rooms and storage areas are often chief sources of damaging ultraviolet light. The installation of low-UV-emitting bulbs or UV-absorbing fluorescent bulb sleeves can help eliminate this problem. Window glazing or the installation of window shades may also help. Low-UV-emitting bulbs and sleeves are available from several manufacturers. Light levels in storage areas can also be controlled by the use of timed shut-off switches. Dark cloths or sheets of folder stock (heavyweight paper) or mat board should be available in reading rooms for covering objects when not in use by readers. Photographs should be covered if they are not immediately returned to storage after use.

Housekeeping

Insects (silverfish, cockroaches, beetles) and rodents (rats, mice, and squirrels) are all attracted to photographic materials. In addition to eating materials, they also foul the storage area and materials with their droppings. They make nests that can be difficult to locate and remove. A good policy is to prohibit eating or drinking where collections are stored. Floors, shelves, boxes, and cabinets should be dusted or vacuumed, or both, on a regular basis. Avoid storing collection materials on the floor where they are more likely to be damaged by insects and rodents or water leaks.

Chemical Processing and Image Stability

Major silver deterioration occurs when photographs are not correctly processed and washed, that is, when exhausted fixer is used or when photographs are not fixed for a sufficient time, or when washing is inadequate. Improper washing fails to rinse residual thiosulfate complexes (fixer) from the film or paper. Residual fixer left in the photograph reacts over time and causes the image, binder, and support to turn yellow or brown and the silver image to fade. High temperature and humidity speed this process. Photographs that were not well fixed remain light sensitive and may darken when exposed to light. Damage from residual chemicals occurs with time and can go unnoticed for years. To prevent this type of damage insist that all photographic chemical processing and development be done to ANSI standards, especially when duplicating negatives, making reference prints from collection negatives, and if feasible, when acquiring new photographs from photographers.

Storage Systems and Enclosures

Proper storage for photographic materials is an important preventive measure that stabilizes delicate or fragile materials and provides basic care for all materials in the collection. Storage cabinetry and enclosures must be chosen and used carefully, however, so that they do not contribute to the deterioration of collection materials. Photographic materials can be seriously damaged if stored in cabinets made of inferior materials that offgas harmful chemicals or that do not provide adequate physical protection. Damage is also caused when photographs are stored loosely in oversized containers or too tightly in overstuffed drawers. Prints stored loosely in a file drawer will slump and curl, for example, and be vulnerable to damage each time the drawer is opened and items are handled. Glass plate negatives are especially fragile and will break when crowded into file cabinets unprotected or stacked on top of one another.

Storage furniture, including cabinets and shelves, should be made of non-combustible, non-corrosive materials such as stainless steel, anodized aluminum, or steel with a powder-coated finish. Shelves made of wood and wood by-products should generally be avoided since they contain lignin, peroxides, and oils that can offgas or migrate to photographic materials. New baked enamel shelving units may offgas harmful chemicals if not properly cured during manufacture.

Prints, negatives, and slides can be damaged by enclosures that are poorly designed or are made of inferior materials. Acidic chemical agents from poor quality materials can migrate to photographs and destroy the images they were meant to protect. Poorly designed enclosures can produce the same result.

Materials

Many commercially available enclosures are labeled "archival" or "acid-free". However, some of these same items may contain lignin, dyes, sizing agents, coatings, plasticizers, or other harmful additives. Never use enclosures made from unprocessed woodpulp paper, glassine, or polyvinyl chloride (PVC) to house or store photographs. Avoid products made from colored papers because they often contain dyes or inks that are unstable and will migrate or bleed onto photographs or otherwise adversely affect the photographs stored within. For an enclosure material to be completely safe it must meet or exceed the specifications in ANSI standard

IT9.2-1991 (or the latest revision) including the Photographic Activity Test (PAT). Purchase enclosure materials from a reputable supplier.

Design

Paper envelopes are often used to store prints and negatives. Adhesives used to seal envelopes may cause staining and fading of the silver image. Thus, the emulsion (or image) side of a print or negative should be placed away from the seam so that staining or fading of the front is less likely. When envelopes with seams are used, the seams should run along the sides of the envelope rather than down the center. A good approach to housing photographs is to provide several layers of protection by first placing photographs into sleeves or envelopes, then into folders, and finally into document storage boxes. This procedure may not be feasible in every institution or with every type of collection. In some cases, grouping photographs into folders and then into storage boxes may suffice.

Paper or Plastic?

The choice between paper or plastic enclosures should be based on the type of photographs to be housed and their condition, the anticipated amount of use the materials will receive, financial resources, and environmental storage conditions. Paper enclosures usually cost less than plastic, but items that are used frequently can be abraded by repeated removal from and insertion into paper enclosures. Paper sleeves and envelopes should be made according to ANSI specifications, which recommend that the paper have an alpha cellulose content of 87% and contain no lignin, groundwood, or alum-rosin sizing. The paper should be buffered to a pH of 7-8.5. Unbuffered paper (tending to have a pH of 6-7) may be preferable for some processes such as cyanotypes. Buffered paper is preferred for acetate and nitrate films, platinum prints, and prints mounted on acidic boards.

Plastic enclosures are preferred for frequently used collections because they protect photographs from finger prints and provide physical support. Plastic enclosures should be made from an inert plastic such as polyester, polyethylene, or polypropylene. These plastics are generally considered non-damaging and may be used safely with many photographic materials. Avoid all plastics that have fillers, coatings, or UV absorbers. Avoid the use of polyester, polyethylene, and polypropylene that has a hazy film on the surface, which indicates that the plastic film is coated or is heavily plasticized. Avoid using adhesives or fasteners that may cause chemical or physical damage, such as rubber cement, pressure-sensitive tape, paper clips, or rubber bands. *Plastic enclosures should not be used with nitrate or early acetate films.*

Suggested Storage Methods

Prints. An ideal storage method for artifactually valuable photographs is to place the print inside a polyester "L" sleeve with a piece of 2-ply board behind the print for added support. A polyester "L" sleeve is made from two pieces of polyester placed on top of one another and joined along two adjacent edges. Place the sleeved photograph into a buffered pH folder and into a document box. Prints larger than 11 by 14 inches should be shelved horizontally. If vertical storage is chosen, be sure the box is snugly filled, or use a spacer to fill unused space to prevent photographs in the box from slumping. If vertical shelving is chosen, make certain the document box is well supported on the shelf. A less costly approach for large collections or collections that receive little use is to place the photograph into an "L" sleeve or a folder and use the 2-ply support only for brittle items.

Oversized prints. Place oversized prints in a folder, interleave with paper, or sleeve in polyester as above. The housed photographs should then be stored in a large document box on shelves or in map storage drawers. Rolling should be avoided since the photograph may crack when it is unrolled for use.

Framed photos. Remove the photograph from the frame and store as above. If framed storage is available, the framed photographs should be protected from light exposure with dark cloth coverings. If the photograph is stored framed, check that the matting is appropriate and of high quality materials.

Glass plate negatives. Intact glass plates may be stored individually, in seamed or seamless paper enclosures. The plates should then be arranged vertically on their long edges in document storage boxes, which can then be stored on open shelving or in cabinets. Seamless sleeves are best for low-use negatives, such as those that have been retired from darkroom use. Shelving with adequate strength is needed to hold the weight of the boxed glass plate negatives. Boxes should be clearly labeled "fragile/glass" and "heavy". Filler 2-ply board or corrugated board should be used to fill out partially filled boxes to minimize jostling of plates during handling. Plates larger than 5 by 7 inches are ideally stored in cabinets with rigid metal dividers spaced every 1 to 1 1/2 inches. *Plates should always be placed on their long edge for vertical storage.*

Broken glass plates, or those with deteriorated image layers. Damaged plates should be stored in sink mats constructed to guidelines suggested by McCabe (1991) with materials that meet the ANSI PAT test. Cracked plates should be supported with a piece of glass or lignin-free ragboard until they can be duplicated, safely sink matted, or examined by a professional conservator. The storage and stabilization of damaged glass plate negatives should be done with the consultation of a conservator.

Nitrate negatives. Cellulose nitrate film was manufactured between 1889 and 1951 in the United States. It was produced into the 1960s in other countries. Kodak was the first to manufacture nitrate film, but it was manufactured by other companies worldwide. Nitrate film is inherently unstable and becomes acidic, sticky, and brittle with age. In large quantities nitrate film can also be a fire hazard, although this risk pertains more to motion picture film than to still photographs stored in individual paper enclosures. Nitrate deteriorates in stages, beginning with a breakdown of the cellulose nitrate plastic support. As nitrate deteriorates it poses a threat to other types of photographs stored in the area by emitting oxides of nitrogen, which attack the silver image, the gelatin binder, and eventually the support base of other papers and films. Nitrate materials should be identified, accurately duplicated, housed in buffered paper enclosures (never plastic), and stored away from other collection materials in a well-ventilated room. Fire codes may require that the nitrate materials be stored separately in fireproof cabinets, or in vaults, or completely off-premises. Storage at low temperature and low RH greatly slows the deterioration of nitrate film.

Cellulose acetate negatives. Starting in the 1930s cellulose nitrate base film was gradually replaced by "safety film" or cellulose acetate films (diacetate, triacetate, acetate propionate, acetate butyrate). All cellulose ester films, including diacetate and triacetate, tend to shrink when plasticizers and solvents introduced during manufacturing evaporate out over time and cause the film base and the gelatin emulsion to cockle and distort. When this happens, the emulsion layer wrinkles and delaminates from the film base support. Eventually the image is distorted by the network of wrinkles or channels formed in the emulsion layer. In addition, the film base becomes increasingly acidic and decomposes. The smell of acetic acid is a sign that the cellulose acetate film base itself is deteriorating and that damage is occurring. Triacetate film, introduced in 1948, is the most stable of the acetate films and is in wide use today. All acetate films should be inspected periodically for signs of deterioration. Deteriorated items should be duplicated before damage worsens and should be stored in buffered paper sleeves, under very stable environmental conditions, while awaiting duplication. Unstable, early acetate negatives should be stored separately from prints in a well-ventilated storage room. Plastic enclosures may be used for recently produced safety film negatives (acetate or polyester) that are expected to receive use. Storage at low temperature and low RH greatly slows the deterioration of acetate film.

Color transparencies. Virtually all color processes are inherently unstable because the final image material consists of organic dyes rather than silver or pigment particles suspended in gelatin. Of the many color processes commercially available, the Cibachrome process is the most stable. Exposure to light will cause most color dyes to fade, but some color dyes will also fade in the dark. In general, high temperatures speed the rate of color fading. Color slides should be housed in suitable plastic sleeves or lignin-free slide storage boxes. Color separations of deteriorated color materials can be made that preserve in silver the three dye layers of the original color image. This, however, is a costly process and may not be feasible for institutions with many color slides. An alternative is to place slides in cold storage (25-40° F and 20-40% RH), which will slow color fading and image loss.

Albums, Scrapbooks, and Mounted Photographs. Historical print mountings were often made of acidic, unstable materials. Many over-the-counter adhesives used to mount photographs into albums and scrapbooks are acidic and will eventually discolor, become brittle, and damage materials. When acidic paper mounts become brittle, the photographic image itself is at risk because of breakage. Mounted photographs that are fragile or brittle may be stabilized with a rigid support such as 4-ply matboard inside a protective enclosure or by placement into a sink mat for protection.

Albums can be wrapped in paper and placed in a document box or in a fitted protective enclosure. On rare occasions albums may be given full conservation treatment, especially if they are particularly valuable. However, this should be the exception rather than the rule. Heavily used albums or scrapbooks should be photographically reproduced. Interleaving should be done judiciously because it adds bulk to an album and places undesirable stress on the binding. Examples where album pages may benefit from the protection provided by interleaving include the following:

photographs that are glossy or easily abraded, or both; photographs that have fixer stains; platinum prints; and photographs with tape or adhesive applied in such a way that it may come in contact with other items in the album.

Handling

The risk of damage to materials is increased when researchers and staff who are responsible for photographic materials are not trained in the proper care and handling of those materials. Ignorance, neglect, and carelessness account for a significant percentage of damage to photographs. Repair of photos with pressure-sensitive tape, marking original prints with ink or felt-tip pens, and exhibition of materials under inappropriate conditions are examples of negligence. Neglect also includes the lack of a disaster response plan, inadequate security precautions, and poor collection management procedures that require valuable originals to be handled repeatedly. Carelessness includes rough handling during cataloging, housing, and viewing, and damage to materials as a result of inadequate transport systems.

When handling photographs and negatives, be sure that hands are freshly washed, wear clean lint-free cotton gloves, and avoid touching the photograph surface. If a photograph must be moved a short distance or turned over during examination, use an auxiliary support (such as a piece of Plexiglas, 2- or 4-ply rag board, or folder stock) to protect the item from damage caused by unnecessary bending and flexing. Use a stable, appropriately sized book cart with horizontal shelves to transfer materials between storage and research areas. Provide book cradles in research areas that allow photograph albums to be viewed safely. Cradles permit a tightly bound book to be opened enough to be read but not so far that it is damaged. Felt covered "snakes" filled with sand can be used to hold pages open as long as they do not touch the surface of photographic materials.

Avoid projecting a color slide longer than ten seconds because the intense projector light causes color dye shift and fading. Slides made for frequent projector use should be on Ektachrome film, which is less prone to color fading under intense projection light. However, Ektachrome is more prone to fading in dark storage than Kodachrome slides. Thus Kodachrome is the preferred slide material if it is not subjected to frequent projection. Recent research suggests that Fujichrome is a good compromise for frequently used slides (Wilhelm, 1990).

Train staff to arrange, describe, and rehouse newly acquired materials with care. Instruct them in the proper method for handling films, glass plates, and prints, as well as brittle, broken, or flaking photographs of all types. Provide adequate storage enclosures and other necessary supplies during housing and cataloging so that materials will be housed properly. Evaluate training procedures on a regular basis and revise them as needed.

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Mark Roosa
Robert Vosper Fellow
February 1992

CARE, HANDLING, AND STORAGE OF PHOTOGRAPHS: Standards

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1990. American National Standards Institute. ***Standard for Imaging Media (Film) - stability of color photographic methods. IT9.9-1990.*** New York: American National Standards Institute.

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Standards are available for purchase from

American National Standards Institute, Inc
1430 Broadway
New York, New York 10018 U.S.A.

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CARE, HANDLING AND STORAGE OF PHOTOGRAPHS:

Supplies

This selected listing of suppliers does not constitute an endorsement of all their products. However, they do sell many items that will meet the storage and handling needs of photographic collections.

Conservation Resources, Inc.
Home Office:
8000-H Forbes Place
Springfield, Virginia
22151 U.S.A.

800-634-6932 phone
703-321-0629 FAX
U.K. Office:
(865)747755 phone
(865)747035 FAX
Canada Office:
(613)523-9260 phone
Australia Office:
(7)52-8159 phone

Crystalizations Systems Inc.
1595A Ocean Avenue
Bohemia, New York
11716 U.S.A.

516-567-0888 phone
516-567-4007 FAX

Delta Designs Ltd.
P.O. Box 1733
Topeka, Kansas
66601 U.S.A.

913-234-2244 phone
913-233-1021 FAX

Foster Manufacturing Co.
414 North 13th Street
Philadelphia, Pennsylvania
19108-1001 U.S.A.

800-523-4855 phone
215-625-0196 FAX

Interior Steel Equipment Co.
2352 East 69th Street
Cleveland, Ohio
44104 U.S.A.

216-881-0100 phone
216-881-0090 FAX

Light Impressions
439 Monroe Avenue
Rochester, New York
14607-3717 U.S.A.

800-828-6216 phone
716-442-7318 FAX

Mayline/Hamilton
The Mayline Co.
619 N. Commerce Street
P.O. Box 728
Sheboygan, Wisconsin
53082-8037 U.S.A.

414-457-5537 phone
414-457-7388 FAX

University Products
517 Main Street
P.O. Box 101
Holyoke, Massachusetts
01041-0101 U.S.A.

800-628-1912 phone
413-532-9281 FAX

S.A. Michael Cauchard
21,23,25 passage Charles-Dallery
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33(1)43 79 21 02 phone
33(1)43 79 98 38 FAX

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#2/5 Using a Camera to Measure Light Levels.
#15/3 Display and Storage of Museum Objects Containing Cellulose Nitrate.
#16/1 Care of Encased Photographic Images
#16/2 Care of Black and White Photographic Glass Plate Negatives.
#16/3 Care of Black and White Photographic Negatives and Film.
#16/4 Care of Black and White Photographic Prints.
#16/5 Care of Photographic Materials.
#16/6 Processing Contemporary Black and White Photographic Films and Paper.

(Available from the Canadian Conservation Institute, 1030 Innes Rd., Ottawa, Canada K1A 0M8).

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Storage and
Handling

STORAGE ENCLOSURES FOR PHOTOGRAPHIC MATERIALS

Storage enclosures for photographic prints and negatives are available in a variety of materials and formats. One must decide between buffered or non-buffered paper, paper or plastic, polyester and other plastics, sleeves or envelopes. Choosing the proper enclosure requires a knowledge of the alternatives. This handout reviews the various options, discussing advantages, disadvantages, and special precautions for each. Whatever enclosure is chosen, avoid handling photographic prints and negatives with bare hands. Oils and perspiration can damage emulsions. Lint-free gloves are available from conservation or photographic suppliers.

All enclosures used to house photographs should meet the specifications provided in the American National Standards Institute (ANSI) Standard IT 9.2-1988.[1] The standard provides specifications on enclosure formats, papers, plastics, adhesives, and printing inks, and requires a variety of enclosure tests.

PAPER MATERIALS

The term "acid-free" is widely used to refer to archival-quality paper materials constructed of either *neutral* or *buffered* paper. A more precise distinction should be made between the two. Neutral enclosures, constructed of paper in the neutral pH range (7.0-7.5) do not contain acids that will damage photos stored in them, but have a limited capacity to absorb acids from the environment or from the objects stored inside. Buffered paper enclosures (approximately pH 8.5) contain an alkaline material that can serve to neutralize acids as they form.

The quality of pulp used to make paper is also important. Groundwood, from which many modern papers are made, contains lignin which produces acids rapidly. Papers described as "lignin-free" are produced from cotton or linen (containing little lignin) or have had the lignin chemically removed. Lignin-free buffered and non-buffered (neutral) paper enclosures are available.

The effect of direct contact of buffered paper on photographic emulsions is presently being questioned. Buffered storage enclosures are not recommended for color images, cyanotypes, or albumen prints. They *are* recommended for cellulose nitrate and early safety film negatives, brittle prints, and photographs on brittle acidic mounts. Research has yet to be conducted to determine the effect of buffering agents on many photographic processes; however, if the relative humidity of the storage environment is below 50%, buffered enclosures should present few, if any, problems. When in doubt, the use of neutral enclosures is probably advisable.

Research has demonstrated that even "archival" papers may be harmful to the photographic image. Labels such as "acid-free" do not guarantee that a material is safe when used with photographs. The only way to be certain of photographic inertness is to have materials undergo the Photographic Activity Test (P.A.T.) as specified in ANSI Standard IT 9.2. The P.A.T. has two components: a test to detect image fading resulting from harmful chemicals in enclosures; and a test to detect staining reactions between enclosures and gelatin. Consumers should contact archival suppliers to see if their products comply with ANSI IT 9.2, and have passed the Photographic Activity Test.[2]

When P.A.T. test results are not available purchase materials from suppliers familiar with the special needs of photographs, and choose enclosures which are lignin-free, 100% rag, and not highly colored (especially avoid black). Glassine enclosures are not recommended.

Advantages and Disadvantages of Paper

1. Paper enclosures are opaque, protecting the object from light. However, this makes viewing difficult, requiring the removal of the object from the enclosure. This increases damage from handling, abrasion, and fingerprinting, especially in heavily used collections.

2. Paper enclosures are porous, protecting the object from the accumulation of moisture and detrimental gases. This is especially important for cellulose nitrate and early safety film negatives where the gases generated by the deterioration of the support material are harmful to the image.

3. Paper enclosures are generally less expensive than plastic enclosures.

4. Paper enclosures are easy to write on.

Seamed Paper Envelopes. An envelope is an enclosure with one open end; it may or may not have a protective top flap. The seam in paper envelopes should be located at the sides and across the bottom. Any adhesives used in construction should be non-acidic and unreactive with silver. Most envelopes come with a thumb cut, but those without are preferred. Thumb cuts allow air to touch the photo, and encourage users to grasp the photo and pull it from the sleeve. [Rather, to remove a photo, push in slightly on the sides of the envelope, and tap the photo out, handling only the edges.] A top flap may be desirable in order to prevent dust from entering the envelope and causing abrasion of the image. When storing photographs in seamed envelopes, the photograph should be inserted with the emulsion away from the seam.

Seamless Paper Envelopes. The seamless envelope does not have any adhesive. The envelope is formed with three or four flaps which fold over to produce a pocket. The fourth flap, if present, closes the envelope completely, protecting the object within from dust and dirt. The construction of this envelope encourages the user to place the object on a flat surface to open it, which can be an advantage for brittle or fragile items such as glass plate negatives. Also, this type of enclosure is constructed so that it can compensate for the thickness of an object.

Paper Folders. A folder is a sheet of paper which is folded in half. It is closed on one side only and must therefore be kept in a properly fitted box in order to effectively hold the image. If used for vertical storage in files, the photograph stored inside must be well supported to prevent sagging or curling. Folders are simple to make and are most useful for large or mounted items.

PLASTIC MATERIALS

Plastic enclosures of archival quality may be made of polyester, polypropylene, or polyethylene. They should not be coated or contain plasticizers or other additives. *Polyester* is the most inert and rigid of the three. It generates static electricity which can attract dust, and it is expensive. Polyester enclosures should be either DuPont Mylar D or ICI Melinex #516. *Polypropylene* is almost as rigid and strong as polyester when in sleeve format, but is soft when used for ring binder storage pages. *Polyethylene* is the softest, most easily scratched, and least rigid of these plastics.

Plastic enclosures made from *polyvinyl chloride* (PVC) are unacceptable for archival photographic storage. This plastic, often referred to as "vinyl" by suppliers, is not chemically stable and will cause deterioration of a photograph over time.

Advantages and Disadvantages of Plastic

1. Plastic enclosures have the great advantage of allowing an image to be viewed without removing it from the enclosure. This greatly reduces the chance of abrading, scratching, or fingerprinting the photograph, especially in heavily-used collections.

2. Moisture and sulphides in the environment react with photographs and hasten their deterioration. Plastic enclosures protect the object from the atmosphere and prolong the life of the image. There are two important exceptions — cellulose nitrate film and early safety film should not be stored in plastic enclosures. Such enclosures accelerate their deterioration by trapping harmful gases.

3. Plastic enclosures can trap moisture and cause ferrotyping (sticking with resulting shiny areas) of the image. This is a particular threat in storage environments with high relative humidity or in the event of a disaster involving water.

4. Plastic enclosures with matte or frosted surfaces

are not recommended, as they can be abrasive and may scratch the emulsion.

5. Plastic enclosures can be very difficult to write on.

6. Plastic enclosures can be flimsy and may require additional support, such as archival-quality Bristol board. Any information which should accompany the image can be recorded on this board.

Plastic Envelopes. Plastic envelopes normally have heat-sealed seams, which eliminate any potential problem with adhesives. Both polyethylene and polyester envelopes have been marketed by conservation product suppliers.

Plastic Folders. These are usually made from polyester. They may be successfully used in conjunction with paper envelopes, the polyester folder protecting the image from handling whenever it is removed from the envelope.

L-Velopes™. These are a combination envelope-folder, being an envelope sealed on only two adjacent sides. This allows for easy insertion and removal of objects, but provides more support than a folder. This format is particularly useful for smaller format images.

Plastic Sleeves. A sleeve is an enclosure open at two opposite sides. It can be made from polyester or polypropylene. Usually, these sleeves are a one-piece construction with a self-locking fold on one edge. This fold provides for easy insertion and removal of the photograph without abrading the image on the sharp edge of the enclosure.

Polyester Encapsulation. Polyester encapsulation encloses a photograph between two sheets of polyester, sealed on all four sides with either double-sided tape or a special polyester welding machine. Encapsulation provides physical support and protection from the environment. It is useful for storing fragile prints, especially those which are torn. Encapsulation is not recommended for photographs adhered to poor quality mounts or for contemporary color photographs.

Ring Binder Storage Pages. These pages are made to fit three-ring binders with slipcases. They are available in a wide variety of formats, sizes, and materials, including polyester, polypropylene, and polyethylene. They are an excellent alternative for small, concentrated collections of uniform size.

Polyester Sheet - Matboard Folder. These folders are made of a sheet of polyester and a sheet of matboard of the same size, attached together along one long edge with double-sided tape. The matboard gives needed support and the polyester allows the image to be easily viewed. These folders should be stored flat. They are particularly useful for storage of oversized photographs or photographs on rigid mounts.

Polyester Sheet Within a Paper Folder. This enclosure consists of a paper folder with a polyester sheet attached along an inner edge, opposite the center fold. The attachment is made with double-sided tape. The polyester holds the object in place and protects it from dirt and handling, but allows for easy viewing and removal. The paper folder provides support to the image and protects it from light. These folders are especially useful for small fragile prints.

SUMMARY

Many of the enclosures available for photographic storage have been described above. Each has been discussed individually, but often two enclosures can be combined to form another format with its own characteristics. An example would be the use of polyester folders with seamed paper envelopes. Each of these systems has advantages and disadvantages. The final choice of enclosure will depend on the particular needs of a collection and available funds.

1. ANSI IT 9.2-1988. "American National Standard for Photography (Processing) - Processed Films, Plates and Papers - Filing Enclosures and Containers for Storage." New York: American National Standards Institute, 1988. (1430 Broadway, New York, New York 10018).

2. This test can be performed by Image Permanence Institute, Rochester Institute of Technology/F.E. Gannett Memorial Building, P.O. Box 9887, Rochester, NY 14623-0887.

GEA: 8/92

COMMISSION ON PRESERVATION AND ACCESS

REPORT

THE CARE AND HANDLING OF RECORDED SOUND MATERIALS

BY GILLES ST-LAURENT
MUSIC DIVISION
NATIONAL LIBRARY OF CANADA

SEPTEMBER 1991

1785 Massachusetts Avenue, N.W., Suite 313, Washington, D.C. 20036-2117 • (202) 483-7474

The Commission on Preservation and Access was established in 1986 to foster and support collaboration among libraries and allied organizations in order to ensure the preservation of the published and documentary record in all formats and to provide enhanced access to scholarly information.

The Commission is accessible via BITNET (CPA@GWUVM, SITTS@GWUVM), and by FAX (202) 483-6410

COMMISSION PREFACE

Although much of the Commission's activities have focused on the preservation of information contained on deteriorating paper, libraries and archives also house and care for information stored on a variety of media. Unlike microfilming of paper-based information sources, standards for preservation reformatting of deteriorating audio and video materials have not yet been established. In the meanwhile, institutions have a responsibility to preserve the non-print materials in their collections.

At the request of a number of colleges and universities that sponsor the Commission, the April 1990 newsletter carried a special report on the care and handling of video recordings. The following report on recorded sound materials -- whose length precludes inclusion in the newsletter -- is an expanded version of an article prepared initially for the National Library of Canada's National Library News. The report provides advice on the care and handling of recorded sound materials in collections, focusing primarily on the nature and composition of the recording media.

The Commission is indebted to NLC and to Gilles St-Laurent for allowing us to distribute the report to our colleagues.

* * *

Complimentary copies of this report have been distributed to the Commission's mailing list. Additional copies are available, while supplies last, from the Commission.

The Commission on Preservation and Access
1785 Massachusetts Avenue, NW, Suite 313
Washington, DC 20036-2117

September 1991

The paper used in this publication meets the minimum requirements of the American National Standard for Information Sciences-Permanence of Paper for Printed Library Materials ANSI Z39.48-1984.

Sound recordings are machine readable artifacts; they are documents for which the integrity of the information they contain is directly related to the artifacts' physical well being. Since the majority of sound recordings are made of plastic, conservation must be treated as a plastics degradation problem, requiring a different approach than paper conservation. It is important to understand the basic chemical degenerative processes and the principles of the retention of sound by the various media in order to ensure that proper action is taken to slow the rate of degradation.

SOUND AND HEARING

Sound can be defined as the change in air pressure above and below an equilibrium (usually the barometric pressure). For example, when a bass drum is struck, the skin vibrates back and forth. As the skin travels outwards, away from the centre of the drum, the air pressure surrounding the drum rises above the barometric pressure; conversely as the drum skin travels inwards, the air pressure lowers. This to-and-fro action occurs numerous times per second creating waves of compression and decompression in surrounding air.

As air pressure increases by the outward motion of the bass drum skin, the eardrum is pushed towards the centre of the head; conversely, as pressure decreases, the eardrum travels away from the center of the head. Therefore, the eardrum physically moves in a parallel motion to the movement of the vibrating bass drum skin. The inner ear converts the change in air pressure into sound by translating the eardrum's mechanical motions into impulses that the brain will perceive as sound. The ear can detect changes in air pressure as slow as 20 cycles per second (a cycle being a complete to-and-fro motion) to as fast as 20,000 cycles per second. The higher the vibration speed, the higher the pitch; the larger the change in air pressure, the louder the sound.

THE RECORDING, RETENTION AND PLAYBACK OF SOUND

The Microphone

The interior of a microphone is comprised of a permanent magnet, a coil of wire and a diaphragm which, like the eardrum, vibrates to changes in air pressure. The vibration of the diaphragm in conjunction with the permanent magnet and the coil converts changes in air pressure into changes in electrical voltage. As air pressure increases, the diaphragm within the microphone is pushed towards the back of the microphone, inducing a voltage; as pressure decreases, the diaphragm travels outwards inducing a voltage in the opposite direction. Like the eardrum, the diaphragm will move in a parallel motion to the movement of the example sound, the vibrating bass drum skin. The resulting voltage will be a continuous parallel voltage image of the movement of that bass drum skin.

If the bass drum were to be tuned at a higher pitch (the skin tightened) the skin would vibrate faster, causing the air pressure to compress and decompress faster, meaning that the diaphragm within the microphone will vibrate faster, consequently forcing the induced voltage to change direction more frequently. A higher pitch will thus be captured on the recording medium. If the drum were to be struck harder, producing a louder sound, the skin vibration would travel a greater distance, creating a higher compression of air, consequently forcing the microphone diaphragm to travel a greater distance thus inducing a larger voltage. The recording would thus be at a higher volume. This chain of events occurs with the recording of any sound. If an orchestra were to be recorded, the collective air pressure change surrounding the orchestra (caused by the mixture of vibrating strings, reeds, etc.) would be captured by the microphone.

The Speaker

Once sound has been converted to an electrical voltage, the "voltage image" can be amplified and then used to drive speakers. Like the skin of the bass drum, the movement of the speaker compresses and decompresses air to produce sound. If the voltage is going upwards, the speaker will travel outwards; if the voltage is going downwards, the speaker will travel inwards. The resulting movement of the speaker will be parallel to the movement of the skin on the bass drum, to the movement of an eardrum, to the movement of the diaphragm within the microphone, and to the induced voltage.

Discs

All records physically retain information in the same fashion and are recorded in a similar manner. Just as a speaker converts a change of voltage to a parallel mechanical motion, so with discs a cutting stylus converts a voltage change to a mechanical motion. When the voltage applied to the cutting stylus goes up, the stylus will move in one direction; when the voltage goes down, the cutting stylus will move in the opposite direction. The movement of the cutting stylus determines the pattern of the groove which, of course, moves in a parallel motion to the movement of the bass drum. Again, the resulting groove shape will be a continuous, identical physical image of the movement of that bass drum skin.

To retrieve information from a disc, a stylus is used to track the groove. The cartridge will convert the movement of the stylus to an electrical voltage (in the same fashion that a microphone converts mechanical motions to an electrical voltage) that can then be amplified and used to drive speakers. The movement of the speaker will be parallel to the movement of the stylus.

Tapes

The binder layer of magnetic tape contains a finite number of ferromagnetic particles whose permanent alignment within the binder records voltage (current) levels.

To record onto tape, the tape must first pass an erase head whose task is to arrange the particles completely randomly. If a small voltage is applied to the record head, then a small percentage of particles will become unidirectionally aligned. If a larger voltage is applied to the record head, then a larger percentage of particles will become aligned. Saturation occurs when there are no more particles available to align. The particles will remain aligned until exposed to a magnetic force.

At playback, the aligned particles will induce a voltage in the playback head. The voltage level will be proportional to the number of aligned particles.

Compact Discs (CDs)

Tapes and discs are analog recordings —the term "analog" referring to the transformation of sound into "parallel", or analogous grooves or particle alignments. Compact Discs, on the other hand, are "digital" recordings. Rather than being a continuous physical image of changes in electrical voltage, digital recordings are based on a series of discrete electrical voltage measurements.

For the CD, the electrical voltage (produced by the microphone) is measured 44,100 times per second. At a certain period in time the voltage might be (for argument's sake) .5 volts out of a maximum 1 volt. $1/44{,}100^{th}$ of a second later the voltage might be .5005 volts, the following $1/44{,}100^{th}$ of a second .5009 volts, etc. As the skin of the bass drum travels outwards, the resulting series of voltage readings get progressively larger; as the skin moves inwards, the resulting series get progressively smaller.

Just as 2:00 p.m. can be expressed as 14:00 hrs, so any value can be expressed using binary digits —1s and 0s. Also, 1/3 can be expressed to .3, or more accurately .33, or better yet .333 etc. The greater the number of decimal places, the more precise the expression of the translation; hence the larger the number of digital bits used in a number, the more accurate the translation. For the compact disc, the number of digital bits used to translate or "digitize" a voltage reading is 16. Thus the compact disc stores one 16 bit number (in addition to other required information) every $44{,}100^{th}$ of a second (per audio channel).

The CD stores information using pits and flat areas wound in a spiral starting at the center of the disc. The edge of a pit (either the ascending edge or descending edge) indicates a one, a flat area either at the bottom of the pit or the land between the pits indicates 0. For example, a 5 bit number of 10001, using pits, would be an edge, a long flat area and another edge.

To play a CD, a laser beam is shone through the clear polycarbonate bottom to the aluminum layer. The light then reflects off the aluminum to a pickup which differentiates between the top and bottom of a pit and interprets these as 1s or 0s. The electronics then build a continuous voltage from these series of stored binary numbers representing the original voltage readings.

THE DEGRADATION MECHANISMS OF SOUND RECORDING

The lifespan of a plastic is largely determined at the manufacturing stage. Variables such as basic resin, the materials added to the basic resin to alter its properties, the lamination of materials with dissimilar properties, and the manufacturing process itself, all directly affect the lifespan of the plastic. Post-manufacture environmental factors such as storage conditions, temperature, humidity, and handling also contribute to the long-term stability of the plastics.

Acetate Discs

Prior to the advent of magnetic tape, instantaneous recordings were made chiefly on acetate discs. The chemical makeup of these discs, therefore, had to be a compromise between ease of engraving and the quality of the recording that resulted.

Since the 1930s, most acetate discs have been manufactured with a base, usually aluminium (although glass was used during the war years and cardboard for inexpensive home recordings), that was coated with nitrocellulose lacquer plasticized with castor oil. Because of the lacquer's inherent properties, acetate discs are the least stable type of sound recording.

Shrinkage of the lacquer coating due to the loss of the castor oil plasticizer is the primary destructive force. The gradual loss of plasticizer causes progressive embrittlement and the irreversible loss of sound information. Because the coating is bonded to a core which cannot shrink, internal stresses result, which in turn cause cracking and peeling of the coating.

Nitrocellulose decomposes continuously and over time reacts with water vapour or oxygen to produce acids that act as a catalyst for several other chemical reactions. These reactions are accelerated with elevated temperature and humidity levels.

Shellac Discs

The first shellac discs date from the 1890s, and this format was used until the 1950s, when it was gradually replaced by vinyl discs.

Shellac discs are relatively stable. Determining the causes of shellac degradation is difficult because a very wide range of qualities of shellac and "fillers" have been used by manufacturers. For example, two separate chemical analyses of "typical" shellac discs showed the following:

Example I[1]	
Flake Shellac	15.63%
Congo Gum	6.51%
Vinsol Resin	5.86%
Carbon Black (low oil content)	2.61%
Zinc Sterate	0.32%
Whiting ($CaCO_3$)	52.13%
Aluminium Silicate	13.03%
Flock (long fibre)	3.91%

1 Pickett, A.G.; Lemcoe, M.M. — *Preservation and Storage of Sound Recordings*. — Washington, D.C.: Library of Congress, 1959.

Example II	
Shellac	22.0%
Copal Gum	7.0%
Silica	33.0%
Barytes	33.0%
Carbon Black	3.0%
Cotton Flock	2.0%

The average shellac content in these "shellac" discs is approximately 19 percent. The remaining aggregates are mostly "fillers" which were used to lower the cost of manufacturing. Unfortunately, storage stabilities of these fillers vary widely. Organic materials in the aggregates are susceptible to fungus attack, while shellac itself is said to be fungus-resistant.

The curing process during shellac manufacturing (wherein raw shellac undergoes chemical reactions under applied stress) generates a condensation reaction between its organic compounds. This reaction causes the shellac to shrink, increasing its density and brittleness. This condensation continues at a much slower rate after disc manufacturing and thus becomes the primary degenerative force. The internal reaction of the material and the rate at which the reaction occurs are related to storage temperature, storage humidity (moisture increases the condensation reaction rate) and completeness of the cured shellac.

In a proper storage environment, these discs suffer a slow, progressive embrittlement of the shellac. This embrittlement causes a fine powder to be shed from the disc after each playback. The behaviour of the other aggregate components is unpredictable, due to the wide combinations and variety of materials (and of material quality) that were used.

Vinyl Discs

Thus far, vinyl has proven to be the most stable of the materials that have been used in the manufacture of sound recordings.[2] However, although stable, its life is not indefinite. Pickett and Lemcoe, in *Preservation and Storage of Sound Recordings*, states that "failure by chemical degradation of a vinyl disc in ordinary library environments should not occur in less than a century".[3]

Vinyl discs are made of polyvinyl chloride (PVC) and a small percentage (usually less than 25 percent) of "fillers", stabilizer, pigment, anti-static substances, etc. Internal plasticization, through a copolymerizing of vinyl acetate with vinyl chloride, is needed to achieve the required properties for the desired application.

Polyvinyl chloride degrades chemically when exposed to ultraviolet light or to heat. Phonograph discs are exposed to high temperatures during moulding and pressing. Unless stopped, this heat would be a catalyst for ongoing dehydrochlorination, which is the release of hydrochloric acid (HCl) from the PVC as a result of thermo-degradation. Stabilization

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2 The stability of the newest format, the compact disc, has not yet been determined.

3 Pickett, A.G.; Lemcoe, M.M. – *Preservation and Storage of Sound Recordings*. – Washington, D.C.: Library of Congress, 1959. p. 31.

is therefore achieved by adding a chemical to the resin during manufacture. This does not prevent the degradation but controls it, mainly by consuming the free HCl. Sufficient effective stabilizer remains in a plastic phonograph disc to protect it for a long time after pressing.

Magnetic Tape

Magnetic tape first appeared in North America just after World War II.

Magnetic tape is made up of two layers: a "base" layer, and a thin "binder" layer which is bonded onto the base. The binder contains ferromagnetic particles whose permanent alignment within the binder produce the copy of sound waves.

1. Magnetic Tape Binder

Manufacturers are very secretive about the specific chemical makeup of their products. Binder chemical composition, uniformity and smoothness of application all affect audio quality, noise level, tape-to-head contact, and friction. These factors also affect the tape's aging properties.

The most common binder resin used today is polyester polyurethane. The most common ferromagnetic particle used is gamma ferric oxide (Fe_3O_2). Numerous additives may be used during the various manufacturing stages, including: solvents, used to obtain a suitable viscosity of emulsion and to improve the mixing and bonding operations; wetting agents, used to break binder/particle mixing tension to produce a more even ferromagnetic particle dispersion within the binder; plasticizers, used to add suppleness to plastic; stabilizers, used mostly as antioxidants to avoid chemical degradation that could lead to physical breakdown; lubricants, used to reduce drag so that speed deviation problems such as "wow" and "flutter" are diminished, and to minimize wear damage to heads; fine mineral powders, used to make polymers harder and more resistant to abrasion; conduction discharge (material such as carbon black), used to discharge electrical charges; and fungicides.

The most common and serious magnetic tape degradation occurs through hydrolysis, the chemical reaction wherein an ester such as the binder resin "consumes" water drawn from humidity in the air to liberate carboxylic acid and alcohol. Hydrolysis in magnetic tape results in the binder shedding a gummy and tacky material which causes tape layers to stick together and inhibits playback when it is deposited onto the tape recorder heads. The added friction increases tape stress and can cause machines to stop. Hydrolysis also causes a weakening in the bond holding the binder to the backing, which results in shedding or possible detachment.

Chromium dioxide (CrO_2) is used extensively as the ferromagnetic particles in cassette magnetic tape. It has been found that CrO_2 particles interact with the polyester polyurethane to accelerate hydrolytic degradation.

Other problems associated with binder manufacturing and deterioration are: incomplete dispersion of the ferromagnetic particles, causing momentary loss of signal ("dropout"); a weak bond that causes the binder to separate from the backing; lubricants that evaporate

to the point where tapes are unplayable; fine oxide powders that shed from tapes and deposit onto heads, inhibiting playback.

2. Magnetic Tape Backing

The backing, which is the structural support of the tape, must resist stresses imposed by playback and storage without becoming permanently deformed (e.g., stretching), or losing dimensional stability (e.g., expanding through absorption of moisture or heat). Most magnetic tape backing has been made of either cellulose acetate or polyester, materials that have dissimilar physical and aging properties.

Cellulose acetate-backed tapes were manufactured from about 1935 until the early 1960s. These tapes rely heavily on plasticizer additives for suppleness, and these plasticizers are liable, over time, to evaporate and crystallize. These tapes have extremely low tensile strength and are easily broken. Cellulose acetate tapes are very susceptible to linear expansion in humid and/or warm conditions. Because of the different properties of the binder and the base, the absorption of humidity and heat result in tape curling and edge fluttering. These distortions greatly affect the tape-to-head contact, which in turn directly affects audio quality. Repeated dimensional changes due to environmental fluctuations grossly affect winding tension and can promote binder fatigue, cracking, and finally, catastrophic failure (i.e., the irreversible loss of sound information).

Polyester ("mylar") came into use in the early 1960s, and quickly replaced cellulose acetate for magnetic tape backing. Accelerated aging tests have found polyester to be a stable material which in fact undergoes hydrolysis degradation at a much slower rate than does the binder, polyester polyurethane, with which it is combined. However, polyester-based tape has a high tensile strength that can cause it to stretch irreparably (instead of breaking cleanly and repairably as does acetate-backed tape).

A third coating is now added to modern tape on the opposite side of the binder. Made of carbon black, it protects the backing from scratches, minimizes static electricity, and provides a more even wind.

PRESERVATION OF SOUND RECORDINGS

A good definition of preservation put forward by the International Institute for Conservation—Canadian Group and the Canadian Association of Professional Conservators is that preservation encompasses "all actions taken to retard deterioration of, or to prevent damage to, cultural property. Preservation involves controlling the environment and conditions of use, and may include treatment in order to maintain a cultural property, as nearly as possible, in an unchanging state."[4]

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[4] International Institute for Conservation–Canadian Group and the Canadian Association of Professional Conservators. — *Code of Ethics and Guidance for Practice: for Those Involved in the Conservation of Cultural Property in Canada.* — The International Institute for Conservation of Historic and Artistic Works-Canadian Group/The Canadian Association of Professional Conservators (CAPC). — [illegible]: 1989, second edition. Page 19.

There are essentially only three concerns to consider when handling and storing sound recordings:

1) **that they be kept free of any foreign matter deposits;**
2) **that they be kept free of any pressure that might cause deformations; and**
3) **that they be stored in a stable, controlled environment.**

1. FOREIGN MATTER DEPOSITS

General

In conservation terms, dirt can be classified into two categories: (1) **Foreign matter deposits** which are not part of the original object, such as grease from fingerprints, soot, stains, adhesives, etc. and (2) **alterations of original object material** through chemical reactions (whether internal reactions or reactions with environmental agents). Metal corrosion products, palmitic acid from acetate discs, or a gummy substance on tapes are examples of alteration in the state of the original.[5]

Dust is commonly a mixture of fragments of human skin, minute particles of mineral or plant material, textile fibres, industrial smoke, grease from fingerprints, and other organic and inorganic materials. There are often salts such as sodium chloride (carried in from sea spray or on skin fragments), and sharp gritty silica crystals. In this chemical mixture are the spore of countless moulds, fungi and micro-organisms which live on the organic material in the dust (fingerprints, for example, serve as good culture media). Much of the dirt is hygroscopic (water-attracting) and this tendency can encourage the growth of moulds, as well as increase the corrosiveness of salts, hydrolysis in tapes and the release of palmitic acids from acetate discs.[6]

Dust (including fingerprints) will negatively affect sound recording preservation in a number of ways:

Discs

Dust is abrasive, and combined with the pressure exerted on the groove walls by the stylus, can permanently etch the walls worse, dust can also be imbedded permanently into the plastic. Only a small point of the stylus is actually making contact with the groove walls. One and a half grams of stylus pressure on such a minute surface translates to several tons of pressure per square inch. The resulting drag generates enough heat that the plastic partially melts (though not enough to deform), causing a microscopic flow around the stylus into which dust can be embedded permanently.

Tapes

Dust attracts and traps moisture and will precipitate hydrolysis, a common and serious cause of long-term magnetic tape degradation. Also, dust will cause permanent damage to the tape when the abrasiveness of the dust along with the pressure exerted between the

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5 Moncrieff, Anne; Weaver, Graham. – *Science for Conservators: Cleaning*. – London: Crafts Council, 1983. Page 14.

6 IBID. Page 14.

tape surface and the tape recorder heads will scratch the oxide layer and the tape recorder heads.

CDs

Since there is no physical contact at playback, there is virtually no chance of physical damage occurring during playback due to dust deposits. Nevertheless, dust will impede proper playback by obstructing the reading of the information, while it may also affect the long-term preservation. At present, the precise, long-term degradation mechanisms for the CD are still unknown. If dust is improperly removed, permanent physical damage will occur owing to the scratching of the protective layer.

To minimize foreign matter deposits:

General:

- Never touch the surface of a recording. Use white lintless cotton gloves and handle by the edges.
- Recordings should not, unnecessarily, be left exposed to air. Return items to their containers when not in use and never leave storage containers open.
- Do not place recordings near sources of paper or cardboard dust.
- Keep the surrounding area clean. Do not consume food or beverages in the area in which recordings are handled.
- Keep storage facilities as dust-free as possible.
- The air conditioning system should be equipped with dust filtering equipment.
- Keep labelling to a minimum, but limit the placement of labels, especially pressure sensitive labels, to the container.
- Keep equipment clean, well adjusted and in good working condition.

Discs

- Do not use paper or cardboard innersleeves and do not store records without inner sleeves.
- Use soft polyethylene inner sleeves. Do not use record sleeves made of PVC.
- Remove LPs from the jacket (with the inner sleeve) by bowing the jacket open by holding it against the body and applying a slight pressure with a hand. Pull the disc out by holding a corner of the inner sleeve. Avoid pressing down onto the disc with the fingers as any dust caught between the sleeve and the disc will be pressed into the grooves.
- Remove LPs from the inner sleeve by bowing the inner sleeve and letting it slip gradually into an open hand so that the edge falls on the inside of the thumb knuckle. The middle finger should reach for the centre label. Never reach into the sleeve.
- To hold a disc, place the thumb on the edge, and the rest of the fingers of the same hand on the centre label for balance. Use both hands on the edge to place disc on turnable.

Tapes

- Do not store paper inside reel-to-reel tape box.
- After removing the end tab from the virgin reel-to-reel tape, cut off one-and-one-half wraps of the tape. This is to avoid any adhesive, left by the end tab, from being transferred to the machine or causing layer-to-layer adhesion of the tape.

CD

- Remove CDs from their case by pressing thumb and third finger on edges near the top and bottom of the case and pressing on the plastic clasp in the center with the other hand.

Cleaning[7]

Since dust is usually held in place by electrostatic attraction, dry wiping on its own does not work effectively. The added friction created by the duster will cause the dust to jump back to the charged surface.

Distilled water is used for cleaning records and CDs for many reasons. Its precise chemical makeup is known, it will not leave any residue behind, is safe to use, and is inexpensive. Water disperses static charges and counteracts the increase in conductivity from the pick-up of salt deposits from finger prints. However, water alone cannot dissolve grease, thus surfactants are used as additives to enable water to be a grease solvent. Surfactants break grease surface bonds and allow water to penetrate grease solids, causing swelling and then random dispersion.

General

- The Canadian Conservation Institute (CCI) recommends the use of nonionic, ethelyne oxide condensates surfactants to clean sound recordings. The CCI does not foresee long-term problems associated with the use of nonionic surfactants such as Tergitol. Tergitol 15-S-3 is an oil soluble surfactant and 15-S-9 is a water soluble surfactant. Combined they remove a wide range of dirt and greases and can safely be used on sound recordings. Use 0.5 part of Tergitol 15-S-3 and 0.5 parts of Tergitol 15-S-9 per 100 parts of distilled water. These products are available in small quantities from TALAS (Division of Technical Library Service Inc) 213 West 35th Street, New York, N.Y. (212) 465-8722.

- Keep an airgun handy to blow off light surface dust.

Discs

- Records are best cleaned using a record cleaning machine such as the Keith Monks, VPI, Nitty Gritty using 0.5 part of Tergitol 15-S-3 and 0.5 parts of Tergitol 15-S-9 per 100 parts of distilled water. These machines allow for an even dispersion of fluid and can then vacuum the liquid leaving a clean, dry surface. Records should be cleaned before each playback.
- Clean acetate discs showing signs of palmitic acid deposits (white greasy substance on acetate disc surface) as if cleaning LPs, except add 2 parts ammonia per 100 to the Tergitol cleaning solution.

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7 **Please Note: Refer to manufacturer safety data sheets for the use of any chemicals mentioned herein.**

Tapes

- Vacuum reel-to-reel tape pack if dusty. Use a vacuum which has a hose, and keep the motor away from the tape in order to reduce the risk of magnetizing the tapes.
- Clean tape surfaces using a product such as 3M "Tape Cleaning Fabric" (610-1-150). This soft fabric product will pick-up loose debris commonly found on tape surfaces after being dislodged by the fabric fibers.

CDs

- An air gun should be used to blow off any light surface dust.
- If fingerprints or other stains must be removed, 0.5 part of Tergitol 15-S-3 and 0.5 parts of Tergitol 15-S-9 per 100 parts of distilled water can be utilized safely. Carefully blot the area of the disc needing washing with a soft cloth (preferably a soft cotton that has been washed several times) imbued with a concentration of Tergitol and distilled water. Rinse well using a second cloth soaked in distilled water. Blot dry using a soft cotton cloth. Use an airgun to blow off any lint left over.
- Avoid rubbing in any direction.

2. SURFACE DEFORMATIONS

Since the surface of a sound recording is the information carrier, it is critical that the surface be well cared for. Physical deformations such as warping of discs, stretching of tape or shock from dropping them, will directly affect sound information integrity. One must develop a respect for the integrity of the artifact.

To minimize deformations

General

- Never leave recordings near sources of heat or light (especially ultraviolet light) as plastics are adversely affected by both.
- Do not place heavy objects on top of recordings. Recordings should never be placed on top of each other.
- Shelve recordings vertically; do not stack "off vertical" or horizontally.
- Do not use shelving units where supports put more pressure on one area of the recording or where supports are more than four to six inches apart.
- Do not interfile recordings of different sizes as smaller items may get lost or damaged, while larger items may be subjected to uneven pressure.

Discs

- Remove shrinkwrap on LPs completely. Shrinkwrap can continue to shrink, thus warping the disc.

Tapes

- Do not drop tapes. The shock could partially rearrange the ferromagnetic particles, effectively attenuating high frequencies.
- Store tapes away from any sources of magnetic fields.
- Do not store reel-to-reel tapes in a plastic bag within tape box. The plastic bag will trap moisture.
- Handle reel-to-reel tapes by the hub rather than the flanges as the pressure on the flanges will damage them and ultimately damage the tape edges.
- Ten-inch reels should have supports in their boxes so that the hub bears the weight of the tapes rather than the flanges.
- Rewind (exercise) reel-to-reel tapes every 3.5 years.
- Store reel-to-reel tapes with an "archival wind". Wind tapes slowly so that air pockets between layers do not form causing successive layers to be placed unevenly on top of each other. The unevenness will cause stress, expose binder to air and exposes edges to possible physical damage by the flanges.
- A reel-to-reel tape deck with the heads removed can be used to rewind tape in the regular play mode. The tape tension might have to be readjusted to compensate for the removal of the heads.

3. Environment

A proper environment for the storage of sound recording is essential to retard degradation mechanisms. Elevated temperature and humidity can affect certain chemical properties of the plastics that make up recording media and can also create an environment that encourages the growth of fungus. Wide or rapid fluctuations of the environment are equally detrimental to the long term preservation of sound artifacts.

Acetate discs

Shrinkage of the lacquer coating due to the loss of plasticizer is the primary destructive force of these discs. Excess moisture will accelerate plasticizer loss. Acetate discs decompose continuously, and over time react with water vapour or oxygen to produce acids that in turn act as catalysts for several other chemical reactions. One of these is the release of palmitic acid, a white waxy substance. Acetate discs are very susceptible to fungus growth. Excess heat will probably accelerate the loss of the coating adhesion.

Shellac discs

High humidity levels accelerate the embrittlement of shellac discs. This embrittlement causes a fine powder to be shed from the disc after each playback, effectively scraping away groove information. The severity of the embrittlement is unpredictable, due to the wide combinations and variety of materials (and of material quality) that were used during their production. The average shellac content in a shellac disc is approximately 19 percent with the remaining 81% composed of aggregates. Organic materials in the aggregates are susceptible to fungus attack, while shellac itself is said to be fungus-resistant.

Vinyl discs

Vinyl discs are adversely affected by ultraviolet light and thermal cycling (heat fluctuation). The consequence of thermal cycling is that each cycle of temperature results in a small

irreversible deformation, and these deformations are cumulative.[8] Vinyl discs are resistant to fungal growth and are unaffected by high humidity levels.

Tapes

Hydrolysis is the chemical reaction whereby the binder resin "consumes" water drawn from humidity in the air to liberate carboxylic acid and alcohol. Hydrolysis in magnetic tape results in the binder shedding a gummy and tacky material which causes tape layers to stick together and inhibits playback when it is deposited onto the tape recorder heads. Hydrolysis also causes a weakening in the bond holding the binder to the backing, which results in shedding or possible detachment.

Cellulose acetate backed tapes are very susceptible to linear expansion in humid and/or warm conditions. Because of the different properties of the binder and the base, the absorption of humidity and heat result in tape curling and edge fluttering. Repeated dimensional changes due to environmental fluctuations grossly affect winding tension (hence the need for periodic rewinding) and can promote binder fatigue, cracking, and finally, the irreversible loss of sound information (known as catastrophic failure). Tape binder is somewhat susceptible to fungi growth though less so with modern tapes as fungicides are presently incorporated into the binder.

CDs

The compact disc is a laminate of 4 different materials. The bottom of the disc is made of polycarbonate onto which the pits containing the digitized sound information are stamped. A thin layer of aluminum is then applied, covering the pits. A thin lacquer coating (which becomes the top of the disc) is then applied to cover the aluminium layer, and finally the ink for the labelling.

As with any laminated products, one must wonder how the aging characteristics of each material will interact with, and affect adjacent layers.

Proper storage environment

- Store recordings at a maintained temperature of between no more than 15-20°C. Fluctuation of temperature should not vary more than 2°C in a 24-hour period.
- Maintain a relative humidity of 25-45%. Fluctuation of relative humidity should not vary more than 5% in a 24-hour period.[9]
- Maintain proper ventilation and air circulation of stacks at all times to avoid any microclimates.
- Keep sound recordings in dark storage when not being consulted. Fit light fixtures with fluorescent tubes which do not produce ultraviolet radiation in excess of 75 µw/lm (microwatts per lumen).

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8 Pickett, A.G.; Lemcoe, M.M. – *Preservation and Storage of Sound Recordings*. – Washington, D.C.: Library of Congress, 1959. Page 41.

9 N.B. ANSI/AES are preparing a report entitled *Environment Storage Conditions* which will deal with the proper storage environment for tapes. It is to be completed by the fall of 1991.

CONCLUSION

Over the past century, recorded sound has become an intrinsic part of our culture. Upon hearing an early sound recording device in 1888, Sir Arthur Sullivan stated that he was "astonished and somewhat terrified at the result of this evening's experiments—astonished at the wonderful power you have developed, and terrified at the thought that so much hideous and bad music may be put on record forever."[10] Unfortunately, sound recordings are not "forever". These are ephemeral documents, both in their physical composition and consequently in the means by which the sound is ultimately retained. They can have their lifespan shortened considerably by both internal and external forces. By undertaking certain precautionary measures, custodians of the heritage of sound can lengthen considerably their collection's lifespan thus preserving a rich, invaluable world of sound.

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10 Moogk, Edward B. – Roll Back the Years: History of Canadian Recorded Sound and its Legacy, Genesis to 1930. — Ottawa: National Library of Canada, 1975. Page viii

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Books and Serials - General Sources

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Merrill-Oldham, Jan, Carolyn Morrow, and Mark Roosa. *Preservation Program Models: A Study Project and Report.* Washington, DC: Association of Research Libraries, 1991.

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